CHEMISTRY
A-PLUS

PUNJAB BOARD NOTES

12TH CLASS

Presented by:

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OBJECTIVES (MCQ'S) OF CHAPTER-1
PERIODICCLASSIFICATION OF ELEMENTS AND PERIODICITY
ACCORDING TO ALP SMART SYLLABUS 2020-21

Topic No 1.2: Modern Periodic Table

1.How many elements are present in 5th period of the periodic table: (2 times)
(a) 32 (b) 8 (c) 18 (d) 28

2.The number of A-subgroups present in modern periodic table are:
(a) 8 (b) 7 (c) 6 (d) 5

3. Transition elements in 4th period are:
(a) 18 (b) 10 (c) 8 (d) 6

4.The basis of Modern periodic law is:
(a) electron affinity (b) atomic mass (c) Ionization energy (d) atomic number

5. Which is the longest period of periodic table?
(a) 4 (b) 5 (c) 6 (d) 7

6. 6th period contains the number of elements:
(a) 18 (b) 32 (c) 8 (d) 10

Topic No 1.3.1: Periodic Trends in Physical Properties

7. The decrease in atomic sizes is not much prominent across rows containing elements of :
(a) s- Block (b) p- Block (c) d- Block (d) f- Block

8. Keeping in view the size of atoms, which order is the correct one: (11 times)
(a) Mg>Sr (b) Ba> Mg (c)Li> Na (d)Cl> I

9. Smaller the size of an ion:
(a) Lesser is the hydration energy (b) Lesser is the polarizing power
(c) Greater in the electron affinity (d) Greater in the energy of hydration

10. Which of the following statement is correct?
(a) Na atom is smaller than Na^+ (b) Na atom is larger than K atom
(c) F atom is smaller than F^- (d) F atom is larger than F^-

11-Mark the correct statement: (8 Times)
(a) Na^+ is smaller than Na atom (b) Na^+ is larger than Na atom
(c)Cl^- is smaller than Cl atom (d) Cl^- (ion) and Cl (atom) are equal in size

12. Keeping in view the size of atoms, which order is the correct one: (6 times)
(a) Mg >Sr (b) Ba > Mg (c) Lu >Ce (d) Cl> I

13- Keeping in view the size of atoms which order is correct.
(a) N > P (b) Br > I (c)Ca> Be (d) Mg >Sr

Tor.. No 1.3.2: Ionization Energy

14. Which of the following elements has lowest ionization energy: (2 times)
(a) Beryllium (b) Boron (c) Carbon (d) Oxygen

15- Among the elements of VA group which has highest ionization energy: (3 times)
(a) Nitrogen (b) Phosphorus (c) Antimony (d) Bismith

16. The ionization energy of calcium is: (2 times)
(a) Lower than that of Barium (b) Lower than that of Magnesium
(c) Higher than that of Beryllium (d) Lower than that of Strontium

Topic No 1.3.4: Metallic Character

17.Choose the correct statement. (4 times)
(a) Metallic character increase down the group
(b) Metallic character decrease down the group
(c)does not change (d) First increase then decrease

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السلام علیکم ورحمۃ اللہ وبرکاتہ:

معزز ممبران: آپ کا وٹس ایپ گروپ ایڈمن "**اردو بکس**" آپ سے مخاطب ہے۔

آپ تمام ممبران سے گزارش ہے کہ:

- گروپ میں صرف PDF کتب پوسٹ کی جاتی ہیں لہذا کتب کے متعلق اپنے کمنٹس / ریویوز ضرور دیں۔ گروپ میں بغیر ایڈمن کی اجازت کے کسی بھی قسم کی (اسلامی وغیر اسلامی، اخلاقی، تحریری) پوسٹ کرنا سختی سے منع ہے۔
- گروپ میں معزز، پڑھے لکھے، سلجھے ہوئے ممبرز موجود ہیں اخلاقیات کی پابندی کریں اور گروپ رولز کو فالو کریں بصورت دیگر معزز ممبرز کی بہتری کی خاطر ریمو کر دیا جائے گا۔
- کوئی بھی ممبر کسی بھی ممبر کو انباکس میں میسیج، مس کال، کال نہیں کرے گا۔ رپورٹ پر فوری ریمو کر کے کاروائی عمل میں لائے جائے گی۔
- ہمارے کسی بھی گروپ میں سیاسی و فرقہ واریت کی بحث کی قطعاً کوئی گنجائش نہیں ہے۔
- اگر کسی کو بھی گروپ کے متعلق کسی قسم کی شکایت یا تجویز کی صورت میں ایڈمن سے رابطہ کیجئے۔
- سب سے اہم بات:

گروپ میں کسی بھی قادیانی، مرزائی، احمدی، گستاخِ رسول، گستاخِ امہات المؤمنین، گستاخِ صحابہ و خلفائے راشدین حضرت ابو بکر صدیق، حضرت عمر فاروق، حضرت عثمان غنی، حضرت علی المرتضیٰ، حضرت حسنین کریمین رضوان اللہ تعالیٰ اجمعین، گستاخ اہلبیت یا ایسے غیر مسلم جو اسلام اور پاکستان کے خلاف پراپیگنڈا میں مصروف ہیں یا ان کے روحانی وذہنی سپورٹرز کے لئے کوئی گنجائش نہیں ہے لہذا ایسے اشخاص بالکل بھی گروپ جوائن کرنے کی زحمت نہ کریں۔ معلوم ہونے پر فوراً ریمو کر دیا جائے گا۔

- تمام کتب انٹرنیٹ سے تلاش / ڈاؤنلوڈ کر کے **فری آف کاسٹ** وٹس ایپ گروپ میں شیئر کی جاتی ہیں۔ جو کتاب نہیں ملتی اس کے لئے معذرت کر لی جاتی ہے۔ جس میں محنت بھی صَرف ہوتی ہے لیکن ہمیں آپ سے صرف دعاؤں کی درخواست ہے۔
- عمران سیریز کے شوقین کیلئے علیحدہ سے عمران سیریز گروپ موجود ہے۔
- **لیڈیز کے لئے الگ گروپ کی سہولت موجود ہے جس کے لئے ویریفکیشن ضروری ہے۔**
- اردو کتب / عمران سیریز یا سٹڈی گروپ میں ایڈ ہونے کے لئے ایڈمن سے وٹس ایپ پر بذریعہ میسیج رابطہ کریں اور جواب کا انتظار فرمائیں۔ برائے مہربانی اخلاقیات کا خیال رکھتے ہوئے موبائل پر کال یا ایم ایس کرنے کی کوشش ہرگز نہ کریں۔ ورنہ گروپس سے تو ریمو کیا ہی جائے گا بلاک بھی کیا جائے گا۔

نوٹ: ہمارے کسی گروپ کی کوئی فیس نہیں ہے۔ سب فی سبیل اللہ ہے

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اللہ تبارک تعالیٰ ہم سب کا حامی وناصر ہو

Topic No 1.3.5: Melting and Boiling Points

18. Which of the following element has lowest melting point:
(a) Beryllium (b) Magnesium (c) Calcium (d) Barium

19. Which of the following has the highest boiling point:
(A) Be (B) Ra (C) Ba (D) Rn

Topic No 1.3.7: Electrical Conductance

20. Mark the correct statement: **(2 times)**
(A) All lanthanides are present in the same group
(B) All Halogens are present in the same period
(C) All the alkali Metals are present in the same group
(D) All the noble gases are present in the same period

21. Which statement is incorrect: **(4 times)**
(a) All the metals are good conductor of electricity
(b) All metals are good conductor of heat
(c) All the metals form positive ions (d) All the metals form acidic oxide

Topic No 1.3.8: Hydration Energy

22. Which ion will have maximum value of heat of hydration? **(2 times)**
(A) Na^{+1} (B) Cs^{+} (C) Ba^{+2} (D) Mg^{+2}

23. Which of the following ion has maximum hydration energy:
(A) Li^{+} (B) Na^{+} (C) K^{+} (D) Ca^{+2}

Topic No 1.4: Periodic Relationship in Compounds

24. Coinage metals are present in the periodic table in group.
(a) I- A (b) I- B (c) II- A (d) II-B

25. The oxides of non-metals are:
(a) acidic (b) amphoteric (c) basic (d) neutral

Topic No 1.5: Position of Hydrogen in Periodic Table

26. Hydrogen resembles in properties with groups:
(a) I-A, V-A, VII-A elements (b) I-A, IV-A, VII-A elements
(c) I-A, III-A, V-A elements (d) I-A, II-A elements

27. The most metallic element from the following is:
(a) Nitrogen (b) Oxygen (c) Antimony (d) Bismuth

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28. Alkali metals are:
(a) Acidic in nature (b) Amphoteric nature
(c) Strong oxidizing agent (d) Strong reducing agents

29. Non-metals are present in which block of periodic table?
(a) s-block (b) p-block (c) d-block (d) f-block

30. Which is more acidic oxide in the following?
(a) MnO (b) Mn_2O_3 (c) MnO_2 (d) Mn_2O_7

31. Which one is not a periodic property:
(a) Ionization Energy (b) Density (c) Atomic Radii (d) Hydration Energy

32. Which one of the following oxides is more basic:
(a) BeO (b) SrO (c) CaO (d) MgO

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
C	A	B	D	C	B	D	B	D	C	A	B	C	B	A	B
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
A	B	A	C	D	D	D	B	A	B	D	D	B	D	B	B

SHORT QUESTIONS OF CHAPTER-1 PERIODICCLASSIFICATION OF ELEMENTS AND PERIODICITY ACCORDING TO ALP SMART SYLLABUS 2020-21

Topic No 1.2: Modern Periodic Table

1. What is modern periodic table.

Ans: __Modern periodic table:__ The table of elements in which, all the elements are arranged in ascending order of their atomic numbers having seven periods and eighteen groups is called modern periodic table.

2. Describe 2nd and 3rd period of periodic table.

Ans: The periods 2 and 3 contain eight elements each and are called short periods. All the elements in these periods are representatative elements and belong to A subgroup. In these periods, every eighth element resemebles in properties with the first element. As lithium and beryllium in the 2nd period resembles in most of their properties with sodium and magnesium of the 3rd period, respectively. Similarly, boron and alumninum both show oxidation state of +3, fluorine in 2nd period has close resemblances with chlorine of 3rd period.

3. Describe 7th period of modern periodic table.

Ans: This period is incomplete. This contains only two normal elements Fr and Ra, ten transition elements and fourteen inner transition elements. The inner transition elements of this period are called "Actinides", as they starts after Ac(Actinium). The actinides are also shown at the bottom of the periodic table under the Lanthanides. Due to their scarcity, the inner transition elements are also called "Rare Earth Elements".

4. Define metalloid.

Ans: __Metalloid :__ Some elements, especially lower members of groups, IIIA, IVA and VA have properties of both metals as well as non-metals. These elements are called metalloids.

5. Give essential features of period four (4) in modern periodic table?

Ans: __Essential features of period four:__
Period four is called long period. It consists of 18 elements. Out of these eight are representative elements belonging to A subgroup similar to second and third period. Where as the ten elements placed in the center of the table belonging to B subgroup and are known as transition elements.

Topic No 1.3: Periodic Trends in Physical Properties

6. Define atomic radius? Why atomic radius of alkali metals increases in group of periodic table

Ans: __Atomic radius:__
Half the distance between the center of the two bonded atoms is called atomic radius. Atomic radius increases from top to bottom in a group of periodic table, this is because of addition of extra shell of electrons in each period.

7. Why melting and boiling points of elements belonging to groups VA –VIIA are lower? **(2 times)**

Ans: Melting and boiling points of elements belonging to groups VA –VIIA are lower because elements of these groups exist as small, covalent molecules, rather than as three dimensional lattices having very weak intermolecular forces between them. Consequently, their melting and boiling points are extremely low.

8. Define Lanthanides and actinides.

Ans: **Lanthanides:**
The elements start after Lanthanum $\left({}_{57}La\right)$ in sixth period are called Lanthanides.
There are 14 elements called Lanthanides from Ce to Lu.
Actinides:
The elements start after actinum $\left({}_{89}Ac\right)$ in seventh period are called actinides.
They are also 14 elements from Th to Lr.

Topic No 1.3.1: Ionic Radii

9. The ionic radius of positive ion is smaller than its parent atom. Give reason.

Ans: The removal of electrons causes an imbalance in proton-electron ratio. Due to greater attraction of the nuclear charge, the remaining electrons of the ion are drawn closer to the nucleus. Thus, a positive ion is always smaller than the neutral atom from which it is derived. The radius of Na is 157pm and the radius of Na^+ is 95pm.

Topic No 1.3.2: Ionization Energy

10. Discuss the trend of ionization energy in periodic table. (3 times)

Ans: **Trend of ionization energy in periodic table:**

1. **Period:**

Ionization energy increases from left to right in a period.

Reason:

i. Atomic size decreases from left to right.
ii. Nucleas charge increses from left to right.

2. **Group:**

Ionization energy decreases down the group.

Reason:

i. Atomic size increases from top to bottom.
ii. Nucleas charge decreases from top to bottom.
iii. Shielding effect increases from top to bottom.
iv. Number of shells increases from top to bottom.

11. Ionization energy of Al^{3+} is greater than Mg^{2+}. Give the reason. (2 times)

Ans: By moving from left to right in a period, the outer shell remains the same, while the nuclear charge increases effectively that makes the removal of an electron difficult and hence the value of ionization energy increases. Similarly the size of Al is smaller than Mg so Al^{3+} it has greater ionization energy than Mg^{2+}.

12. Why first ionization energy of Mg is greater than that of Na? (2 times)

Ans: By moving from left to right in a period, the outer shell remains the same, while the nuclear charge increases effectively that makes the removal of an electron difficult and hence the value of ionization energy increases. Similarly the size of Mg is smaller than Na so Mg has greater ionization energy than Na e.g.

$$Na \longrightarrow Na^+ + e^- \quad I.E = 496\ kJ\ mol^{-1}$$
$$Mg \longrightarrow Mg^+ + e^- \quad I.E = 738\ kJ\ mol^{-1}$$

Topic No 1.3.3: Electron Affinity

13. Define electron affinity. Give its trend in periodic table. (4 times)

Ans: **Electron affinity:** Energy released or absorbed, when an electron is added to a gaseous atom to form a negative ion is called electron affinity.

Trend of electron affinity in periodic table:

1. **Period:**

Electron affinity increases from left to right in a period.

Reason:

i. Atomic size decreases from left to right.
ii. Nucleas charge increses from left to right.

2. **Group:**

Electron affinity decreases down the group.

Reason:

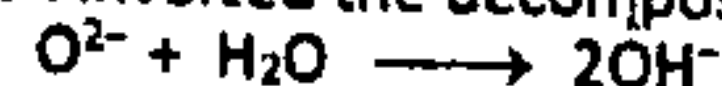
i. Atomic size increases from top to bottom.
ii. Nucleas charge decreases from top to bottom.
iii. Shielding effect increases from top to bottom.
iv. Number of shells increases from top to bottom.

14. Solution of Na_2O in water is alkaline. Justify the statement. (2 times)

Ans: Alkali metal oxides dissolve in water to give alkaline solutions. For example:

$$Na_2O + H_2O \longrightarrow 2NaOH$$

The reaction of alkali metal oxide with water is an acid-base reaction. The reaction involved the decomposition of water molecule by an oxide ion as:

$$O^{2-} + H_2O \longrightarrow 2OH^-$$

Topic No 1.3.5: Melting and Boiling Points

15. Melting points of Group VIIA elements increases down the group. Why?

Ans: For elements of group VIIA, which exist in the form of molecules, the melting and boiling points increase down the group. This is because large molecules exert stronger force of attraction due to their higher polarizabilities.

16. Why do boiling point of halogens increase down the group in periodic table?

Ans: Boiling point of halogens increase down the group in periodic table , because halogens exist in the form of molecules and large molecules exert stronger London forces of attraction due to their higher polarizabilities.

Topic No 1.3.6: Oxidation State

17. Why the oxidation state of noble gases is usually zero? (7 times)

Ans: Group VIII A elements, which are also called zero group elements usually show zero oxidation state because there is no vacancy in their outer most shell to accommodate more electrons.

18. How do member of group VI-A(except oxygen) show +2, +4 and +6 oxidation state?

Ans: Elements of group VI-A except oxygen show covalency of +2,+4 and +6 oxidation state. +2 oxidation shown due to 2 unpaired electrons in the p orbitals. +4 oxidation state is shown when 1 electron from p-orbital is promoted to the next vacant d-orbital, while +6 oxidation state is shown when another electron from s-orbital is also promoted to the next vacant d-orbital.

Topic No 1.3.7: Electrical Conductance

19. Why do metals conduct electricity?

Ans: **Metals conduct electricity:** Metals conduct electricity because metals have loose (free) electrons in their outer most shell and there is an ease of their movement in the solid lattice.

20. Electrical conductance of metals in group IA generally increases from top to bottom. Explain (2 times)

Ans: The property is mainly due to the presence of relatively loose electrons in the outermost shell of the elements and ease of their movement in the solid lattice. In group IA , generally electrical conductance increases from top to bottom because from top to bottom loosely held electrons are more easily available.

21. Why the metals are good conductors?

Ans: Metals are good conductors due to the presence of relatively loose electrons in the outermost shell of the element and ease of their movement in the solid lattice.

Topic No 1.3.8: Hydration Energy

22. Give reason that Hydration Energy of Al^{3+} ions is more than Mg^{2+} ions. (2 times)

Ans: Hydration energy is highly depends upon charge to size ratio of the ions. Charge to size ratio increases from left to right in a period, the hydration energy also increases in the same fashion.

23. Hydration energy depends on charge density of ion. Justify the statement.

Ans: Hydration energy depends on charge to size ratio of the ion. For example of group IA, charge to size ratio decreases from top to bottom in a group, the hydration energy also decreases in the same fashion.

24. Hydration energy decreases from top to bottom, why?

Ans: **Trend of Hydration energy:**

Hydration energy highly depend upon charge to size ratio of the ions. Charge to size ratio decreases from top to bottom in a group.

Topic No 1.4: Periodic Relationship in Compounds

25. Define hydration energy. How it varies is group in periodic table? (2 times)

Ans: **Hydration energy:** The hydration energy is the heat absorbed or [illegible] when one mole of gaseous ions dissolve in water to give an infinitely diluted solution.

Example: One mole of gaseous hydrogen ions are dissolved in water resulting as infinitely diluted solution, as large amount of heat is liberated:

$$H^+_{(g)} + H_2O_{(l)} \longrightarrow H_3O^+_{(aq)} \qquad \Delta H_{hyd} = -1075 kJmole^{-1}$$

Trend in group of periodic table: In group of periodic table it decreases because charge to size decreases from top to bottom in a group.

Topic No: 1.5: Position of Hydrogen in Periodic Table:

26. Justify that carbon and hydrogen are both reducing agents.

Ans: **Carbon and hydrogen are both reducing agents:**

i. Valence shell of hydrogen is half filled like those of group IVA elements.

ii. Both, hydrogen and group IVA elements combine with other elements through covalent bonding.

iii. Like carbon, hydrogen also possesses remarkable reducing properties.

$CuO + H_2 \longrightarrow Cu + H_2O$

$SnO_2 + C \longrightarrow Sn + CO_2$

27. In what respects does hydrogen differ from halogens? Write down two dissimilarities.

Ans: (i). Hydrogen forms H^+ ion by losing its valence electron but halogens do not form positive ions.

(ii). Hydrogen combine with oxygen and form stable oxides while halogens lack this property.

28. Write any two resemblances of Hydrogen with Alkali Metals. (3 times)

Ans: Hydrogen is placed at the top of the group IA. This is because of the fact that some of the properties of hydrogen resembles with those of alkali metals. Like alkali metal hydrogen atom has one electron in 1s subshell, which it can lose to form H^+. Both hydrogen and alkali metals have a strong tendency to combine with electronegative elements such as halogens. Similar to alkali metals hydrogen also forms ionic compounds, which dissociate in water.

LONG QUESTIONS OF CHAPTER-1
PERIODICCLASSIFICATION OF ELEMENTS AND PERIODICITY
ACCORDING TO ALP SMART SYLLABUS 2020-21

Topic No: 1.2:

1. What are periods? Describe different periods of periodic table. (2 times)

Ans: (Text Book Page No:2)

2. Explain main features of Modern Periodic Table.

Ans: (Text Book Page No:2)

3. Define group and period. Discuss only the 6th period in detail.

Ans: (Text Book Page No:2+4)

4. Discuss four blocks in modern periodic table. (2 times)

Ans: (Text Book Page No:5)

Topic No:1.3.1

5. Explain periodic trends in the following physical properties.
(i) Atomic radius (ii) Electron affinity

Topic No:1.3.2

6. Define ionization energy? How does it differ along the period and down the group ofperiodic table? (5 times)

Ans: (Text Book Page No:6+7)

Topic No:1.3.3

7. Define Electron affinity. How does it vary in groups and periods generally in periodic table?

Ans: (Text Book Page No:8)

Topic No:1.3.4

8. Give the periodic trends of ionization energy and electron affinity. (2 times)

Ans: (Text Book Page No:7,8)

9. Describe trend of metallic character in groups and periods and discuss the impact of atomic size on it.

Ans: (Text Book Page No:8)

10. Describe the Metallic and Non- Metallic character of element in periodic table.

Ans: (Text Book Page No:8)

Topic No:1.3.5

11. Explain periodic trend in the following physical properties.
(i) Melting point (ii). Boiling point

Ans: (Text Book Page No:9)

Topic No:1.3.6

12. Discuss oxidation state of different elements in the periodic table.

Ans: (Text Book Page No:9)

Topic No: 1.7

13. Explain the variation of (i) Ionization potential
(ii) Electrical conduction along periods and groups. (2 times)

Ans: (Text Book Page No:7+10)

14. Why diamond is non-conductor and graphite is fairly a good conductor? (4 times)

Ans: (Text Book Page No:10)

Topic No: 1.8

15. Define Hydration Energy. Give example. Explain its trends in periodic table. (2 times)

Ans: (Text Book Page No:11)

16. Define hydration energy. Discuss the relation of hydration energy with size and charge on the ions.

Ans: (Text Book Page No:11)

17. Discuss the position of hydrogen in group IV- A of periodic table.

Ans: (Text Book Page No:14)

18. How hydrogen resembles with group I-A elements and differs group IV-A elements? (5 times)

Ans: (Text Book Page No:15)

19. Discuss position of hydrogen in group Ist & VII(A) of periodic table. (7 times)

Ans: (Text Book Page No:15)

OBJECTIVES (MCQ'S) OF CHAPTER-2
s-BLOCK ELEMENTS
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 2.1 Introduction, Occurrence

1. Which one of the following does not belong to alkaline earth metals? (5 times)
(a) Be (b) Ra (c) Ba (d) Rn

2. Elements of group I A are called:
(a) Alkali metals (b) Metalloids (c) Alkaline earth metals (d) Coinage metals.

3.Carnalite is the mineral of:
(a) Be (b) Na (c) Mg (d) Ca

4. Elements of group II-A are called:
(a) Coinage Metals (b) Alkali Metals (c) Metalloids (d) Alkaline Earth Metals

5.Which is the least reactive of all alkali metals?
(a) Li (b) Na (c) K (d) Cs

6. The word alkali is derived from which language:
(a) Arabic (b) Greek (c) French (d) German

7.$LiNO_3$ decompose to give products.
(a) $Li_2O + NO_2 + O_2$ (b) $Li_2O + NO + O_2$ (c) $Li_2O + NO$ (d) $Li_2O_2 + NO_2 + O_2$

8.Which is not an alkali metal? (4 times)
(a) Francium (b) Cesium (c) Rubidium (d) Radium

9.Chile saltpetre has the chemical formula: (6 times)
(a) $NaNO_3$ (b) KNO_3 (c) $Na_2B_4O_7$ (d) $Na_2CO_3.H_2O$

10. The ore $CaSO_4.2H_2O$ has the general name: (6 times)
(a) Gypsum (b) Dolomite (c) Calcite (d) Epsom salt

Topic No: 2.2: Peculiar behavior, General properties:

11. Which one of the following elements can from super oxide?
(a) Li (b) Be (c) K (d) Mg

12-Point out the element which forms supper oxide:
(a) Li (b) Na (c) K (d) C

13. Which of the following sulphates is not soluble in water? (2 times)
(a) Sodium Sulphate (b) Potassium Sulphate
(c) Ammonium Sulphate (d) Barium Sulphate

Topic No: 2.3: Down's cell (Na-metal):

14. $CaCl_2$ is added to NaCl in Down's cell to: (3 times)
(a) decrease solubility (b) decrease dissociation
(c) decrease melting point (d) decrease conductivity

15.Down's cell is used to prepare:
(a) Sodium metal (b) Sodium bicarbonate (c) Sodium carbonate (d) Sodium hydroxide

16. Which element is deposited at cathode during electrolysis of brine? (4 times)
(a) Na (b) O_2 (c) Cl_2 (d) H_2

Topic No: 2.4 Nelson's cell (NaOH):

17. Nelson's cell is used to prepare:
(a) NaOH (b) Na_2CO_3 (c) Na metal (d) $NaCl$

2019

18. Compound obtained when Na burns in excess of air
(a) NaO_2 (b) Na_2O_2 (c) Na_2O (d) Na_2O_3

19. Element Cs (Cesium) shows resemblance with:
(a) Ca (b) Cr (c) both a, b (d) Fr

20. General name of mineral $MgSO_4.7H_2O$ is?
(a) Gypsom (b) Dolomite (c) Calcite (d) Epsom salt

21. Which sulphate is not soluble in water?
(a) Sodium sulphate (b) Potassium sulphate (c) Zinc sulphate (d) Barium sulphate

22. Formula of Epsom salt is:
(a) $MgSO_4.7H_2O$ (b) $MgSO_4$ (c) $MgCO_3$ (d) $CaMg_3(SiO_3)_4$

23. Which ion will have the maximum value of heat of hydration?
(a) Na^+ (b) Cs^{2+} (c) Ba^{2+} (d) Mg^{2+}

24. Formula of Epsom salt is:
(a) $MgSO_4.7H_2O$ (b) $MgSO_4$ (c) $MgCO_3$ (d) $CaMg_3(SiO_3)_4$

ANSWERS TO MULTIPLE CHOICE QUESTIONS

1	2	3	4	5	6	7	8	9	10	11	12	13
D	A	C	D	A	A	A	D	A	A	C	C	D
14	15	16	17	18	19	20	21	22	23	24		
C	A	D	A	B	D	D	D	A	D	A		

SHORT QUESTIONS OF CHAPTER-2
S-BLOCK ELEMENTS
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 2.1 Introduction, Peculiar behaviour of Li & Be:

1 Why S-block elements are called as alkali metals and alkaline earth metals?

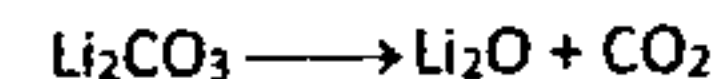
Ans: The name alkali came from Arabic, which mean 'The Ashes'. The arab used this term for these metals because they found that the ashes of plants were composed chiefly of sodium and potassium. Elements of group IA are called alkali metals, because they produce alkaline solutions with water.
Elements of group IIA are called alkaline earth metals. The alkaline earth metals are beryllium, magnesium, calcium, strontium, barium and radium. They are called alkaline earth metals because they produce alkalies in water and are widely distributed in earth crusts.

2 Which elements are called as alkaline earth metals? Why this name is used for these elements?

Ans: Elements of group IIA are called alkaline earth metals. The alkaline earth metals are beryllium, magnesium, calcium, strontium, barium and radium. They are called alkaline earth metals because they produce alkalies in water and are widely distributed in earth crusts.

3 Why lithium carbonate decomposes on heating while other alkali metal carbonates remain unaffected?

Ans: Lithium has low electropositive character, thus its carbonate and nitrate are not so stable and therefore decompose giving lithium oxide. Carbonates of other alkali metals do not decompose.

$$Li_2CO_3 \longrightarrow Li_2O + CO_2$$

4 Complete and balance the equations: (a) $LiNO_3 + heat \longrightarrow ?$ (b) $Mg(NO_3)_2 + heat \longrightarrow ?$

Ans: $2LiNO_3 + heat \longrightarrow 2Li_2O + 4NO_2 + O_2$
$Mg(NO_3)_2 + heat \longrightarrow 2MgO + 4NO_2 + O_2$

5 Why group II -A elements are called Alkaline Earth Metals. (3 times)

Ans: Group IIA elements are called alkaline earth metals because they produce alkalies in water and are widely distributed in earth's crusts.

6. Write a brief note on the occurrence of alkaline earth metals?

Ans: Occurrence of alkaline earth metals: Being very reactive, alkaline earth metals also do not occur in free state. The compounds of these metals occur widely in nature.
Magnesium and calcium are very abundant in earth's crust. The outer portion of the earth was originally in the form of silicates and alumino-silicates of alkaline earth metals. Calcium phosphate, and calcium fluoride are also found as minerals. Calcium is an essential constituent of many living organisms. It occurs as skeletal material in bones, teeth, sea shells and egg shells.
Radium is a rare element. It is of great interest because of its radioactive nature.

7. Lithium is least reactive element of all alkali metals .Give reasons

Ans: Lithium is least reactive element of all alkali metals:
Lithium is least reactive element of all alkali metals because of its small radius and high charge density. The nuclear charge of Li^+ ion is screened only by a shell of two electrons. The so called 'anomalous' properties of lithium are due to the fact that lithium is unexpectedly far less electropositive than other alkali metals.

8. Write any two points of difference of Be with its family members.

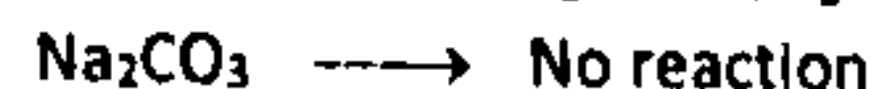
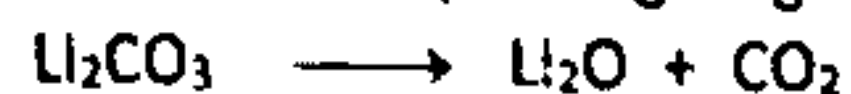
Ans: Beryllium is the lightest member of the series. The main points of difference are:

1. Beryllium metal is almost as hard as iron and hard enough to scratch glass. The other alkaline earth metals are much softer than beryllium but still harder than the alkali metals.
2. The melting and boiling points of beryllium are higher than other alkaline earth metals.

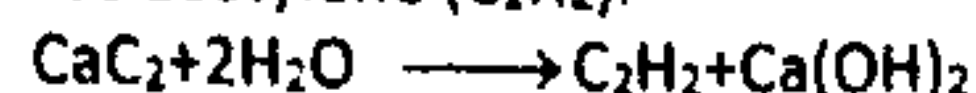
9. What happens when : (i) Li_2CO_3 (ii) Na_2CO_3 is heated

Ans: Lithium has low electropositive character, thus its carbonate are not so stable and therefore decomposed giving lithium oxide on heating.

$$Li_2CO_3 \longrightarrow Li_2O + CO_2$$

$$Na_2CO_3 \longrightarrow \text{No reaction}$$

10. What happens when CaC_2 is Hydrolyzed.

Ans: CaC_2 on hydrolysis yields acetylene (C_2H_2).

$$CaC_2 + 2H_2O \longrightarrow C_2H_2 + Ca(OH)_2$$

11. Differentiate between alkali and alkaline earth metals. Give one example in each case.

Ans: **Alkali metals:** Elements of group IA except Hydrogen are called Alkali metals. e.g; Li, Na, K, Rb, Cs, Fr

Alkaline earth metals: Elements of group II-A are called alkaline earth metals. e.g; Be, Mg, Ca, Sr, Ba and Ra.

Topic No: 2.2: General Properties:

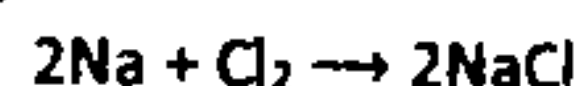
12. Alkali and alkaline earth metals are reactive elements of periodic table.Justify it.

Ans: Alkali and alkaline earth metals are reactive elements of periodic table because, these elements are most electropositive elements. Alkali metals have only one electron in their valence shell. Ionization energy values of alkali metals are very low.

Alkaline earth metals have two electrons in their valence shell. These also have very low ionization values. So both alkali and alkaline earth metals are reactive.

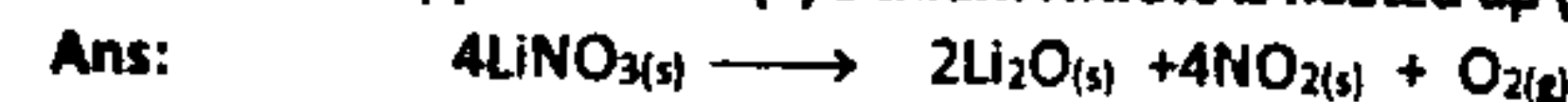
13. Give reason that alkali metals are strong reducing agents? (5 times)

Ans: The reducing property of an element depends on the magnitude of its ionization energy. Reducing agent is a substance which can lose electron. Since alkali metals have got low ionization energies, so they are strong reducing agents. They are highly electropositive. They react readily with halogens giving alkali metal halides.

$$2Na + Cl_2 \longrightarrow 2NaCl$$

14. What happens when (a) Lithium Nitrate is heated up (b) Sodium Nitrate is heated up.

Ans:

$$4LiNO_{3(s)} \longrightarrow 2Li_2O_{(s)} + 4NO_{2(s)} + O_{2(g)}$$

$$2NaNO_{3(s)} \longrightarrow 2NaNO_{2(s)} + O_{2(g)}$$

15. It is easier to decompose Li_2CO_3 than K_2CO_3. Justify.

Ans:

$$Li_2CO_3 \longrightarrow Li_2O + CO_2$$

Li_2CO_3 is easily decomposed because gain in electrostatic force of attraction in converting carbonate to oxide is considerable.

Due to large cation like K^+ ion K_2CO_3 is more stable and not easily decomposed.

Topic No: 2.3: Manufacture of Sodium:

16. Why is $CaCl_2$ added in molten NaCl in Down's cell. (3 times)

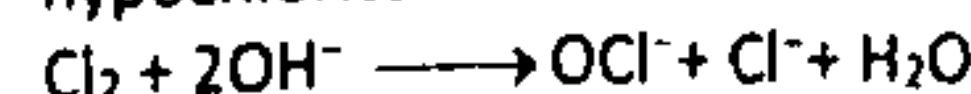
Ans: **$CaCl_2$ added in molten NaCl in Down's cell:**

Sodium chloride is used as raw material in Down's cell. The melting point of sodium chloride is 801 °C. Some calcium chloride is added to lower the melting point of sodium chloride. Calcium chloride permits the furnace to operate at about 600 °C.

Topic No: 2.4: Manufacture of NaOH:

17. Mention two major problems that may arise in Nelson's cell.

Ans: (i). Chlorine produced can react with hydroxide ions in cold giving hypochlorite ions.

$$Cl_2 + 2OH^- \longrightarrow OCl^- + Cl^- + H_2O$$

(ii). Hydroxide ions may be attracted toward anode, where they can be discharged releasing oxygen gas. This oxygen gas may contaminate the chlorine and renders it impure.

18. Write the advantages of Nelson's cell.

Ans:

(i). By using this method sodium hydroxide is manufactured on large scale.

(ii). Sodium hydroxide is product of this process but some by products are also achieved like hydrogen gas and chlorine gas.

(iii). It is very cheap process because its raw material is sodium chloride (rock salt) which is not costly.

19. How chlorine produced in Diaphragm cell, is protected to react with Hydroxide ions?

Ans: Chlorine produced can react with hydroxide ions. To prevent this problem asbestos diaphragm is used. This keeps the two solutions separate while allowing sodium ions to move towards the cathode. This movement of ions keep the current following through the external current.

LONG QUESTIONS OF CHAPTER-2 s-BLOCK ELEMENTS ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 2.1:

1 Show four chemical reactions in which Li behaves different from elements of its own group. (6 times)

Ans: (Text Book Page No:23)

2 Compare the chemical behavior of lithium with magnesium.

Ans: (Text Book Page No:28)

3 Discuss peculiar behavior of Beryllium with respect to other member of II-A group. (10 times)

Ans: (Text Book Page No:24)

Topic No: 2.2

4 Give the reaction of sodium with oxygen.

Ans: (Text Book Page No:25)

Topic No: 2.3

5 Describe the commercial preparation of sodium by Down's cell. What are advantages of this process? (17 times)

Ans: (Text Book Page No:29)

6 Explain the construction of Down's cell. Give reactions taking place at cathode and anode.

Ans: (Text Book Page No:29+30)

Topic No: 2.4

7 Describe preparation of sodium hydroxide by Nelson's Diaphragm cell. (7 times)

Ans: (Text Book Page No:30)

OBJECTIVES (MCQ'S) OF CHAPTER-3
GROUP IIIA AND GROUP IVA ELEMENTS
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 3.1: Group IIIA Elements:

1. Which elements forms an ion with charge +3? **(2 times)**
(a) Be (b) Al (c) C (d) Si

2. Elements having less than four electrons in its valence shell but it is not a metal:
(a) B (b) Al. (c) Ga (d) In

3. Valence shell electronic configuration of the elements of group III-A is:
(a) ns^1, np^2 (b) ns^2, np^3 (c) ns^0, np^3 (d) ns^2, np^1

4- Which element forms an ion with charge 3+ **(4 times)**
(a) Be (b) Al (c) Si (d) C

5- Which of the following is non-metal?
(a) B (b) Al (c) Ga (d) In

6-Which of the following element is not present abundantly in earth's crust: **(5 times)**
(A) Silicon (B) Aluminium (C) Sodium (D) Oxygen

7- Borax has the chemical formula:
(A) KNO_3 (B) $NaNO_3$ (C) $Na_2B_4O_7.10H_2O$ (D) $Na_2CO_3.H_2O$

8- Chemical Composition of Colemanite is: **(3 times)**
(A) $Ca_2B_6O_{11}.5H_2O$ (B) $CaB_4O_7.4H_2O$ (C) $CaNaB_5O_9.8H_2O$ (D) $Na_2B_4O_7.4H_2O$

Topic No: 3.1.1: Occurrence (Boron and Aluminium):

9. Tincal is a mineral of: **(10 times)**
(a) Al (b) Boron (c) Silicon (d) Carbon

10. Kaolin is mineral of:
(a) Aluminium (b) Magnesium (c) Calcium (d) Barium

11. The chief ore of aluminium(Al) is: **(8 times)**
(a) Na_3AlF_6 (b) $Al_2O_3.2H_2O$ (c) Al_2O_3 (d) $Al_2O_3.H_2O$

12. Bauxite is a mineral of: **(2 times)**
(a) B (b) Be (c) Mg (d) Al

Topic No: 3.2.1: Compounds of Boron:

13. The aquous solution of borax is: **(2 times)**
(a) Acidic (b) Basic (c) Neutral (d) Corrosive

14. Boric acid can not be used: **(4 times)**
(a) An antiseptic in medicine (b) For washing eyes
(c) In soda bottles (d) For enamels and glazes

15. In Borax bead test, colour of cupric borates are:
(a) Blue (b) Red (c) Green (d) Colourless

Topic No: 3.3: Reactions of Aluminium:

16. Which metal is used in the thermite process because of its activity? **(10 times)**
(a) Iron (b) Copper (c) Aluminium (d) Zinc

17. Which metal is used in the flash light photography because of its activity?
(a) Iron (b) Copper (c) Aluminium (d) Zinc

Topic No: 3.4: Group IVA Elements:

18- Which element among the following belongs to group IVA of periodic table?
(a) Barium (b) Iodine (c) Tin (d) Oxygen

Topic No: 3.7

19. The stable yellow modification of Lead chromate is:
(a) Triclinic (b) Hexagonal (c) Tetragonal (d) Monoclinic

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

1	2	3	4	5	6	7	8	9	10	11	12
B	A	D	B	A	C	C	A	B	A	B	D
13	14	15	16	17	18	19					
B	C	A	C	C	C	D					

SHORT QUESTIONS OF CHAPTER-3
GROUP IIIA AND GROUP IVA ELEMENTS
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 3.1: Group IIIA Elements, Occurrence of Boron and Aluminium:

1 Write formulas of Borax and Chile Saltpeter. **(2 times)**
Ans: Formula of Borax : $Na_2B_4O_7.10H_2O$
Formulae of Chile Saltpeter : $NaNO_3$

2 Write down formulas for Tincal and Orthoboric acid?
8Ans: Formula for Tincal : $Na_2B_4O_7.10H_2O$
Formula for orthoboric acid : H_3BO_3

3 Give formulas of following : (a)Tincal (b) Mica
Ans: (a). Formulas of Tincal : $Na_2B_4O_7.10H_2O$
(b). Formula of Mica : $KH_2Al_3(SiO_4)_3$

4. Write formulas of : (i) Colemanite (ii) Cryolite
Ans: Formulas of Colemanite = $Ca_2B_6O_{11}.5H_2O$
Formulas of Cryolite = Na_3AlF_6

5. Write the formula of (a) Bauxite (b) Cryolite
Ans: Formulae
(a) Bauxite = $Al_2O_3.2H_2O$ (b) Cryolite = Na_3AlF_6

Topic No: 3.1.2: Peculiar Behaviour of Boron:

6. Write any two properties of boron which show peculiar behavior?
Ans: (i). Boron is only element in Group IIIA which is non-metallic in behaviour.
(ii). It is the only element with less than four electrons in the outermost shell which is not a metal

Topic No: 3.2.1: Borax:

7. What happens when borax is heated with NH_4Cl?
Ans: **Reaction of borax with NH_4Cl:** When borax is heated with ammonium chloride, boron nitride is produced. $Na_2B_4O_7 + 2NH_4Cl \rightarrow 2NaCl + 2BN + B_2O_3 + 4H_2O$

8. What happens when borax is treated with HCl and H_2SO_4 separately?
Ans: Aqueous solution of borax reacts with HCl or H_2SO_4 to form boric acid.

$$Na_2B_4O_7 + 2HCl + 5H_2O \longrightarrow 4H_3BO_3 + 2NaCl$$
$$Na_2B_4O_7 + H_2SO_4 + 5H_2O \longrightarrow 4H_3BO_3 + Na_2SO_4$$

9. Aqueous solution of borax is alkaline in nature. Justify the statement. (4 times)
Ans: Aqueous solution is alkaline in nature due to hydrolysis.

$$Na_2B_4O_7 + 7H_2O \longrightarrow 2NaOH + 4H_3BO_3$$
Borax Strong alkali Weak acid

10 Justify that solubility of borax changes with change in temperature.
Ans: It is sparingly soluble in cold water but is more soluble in hot water: 100 grams of water dissolve 3 grams of decahydrate at 10 °C and 99.3 grams at 100 °C.

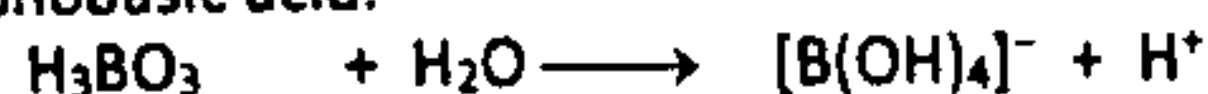
Topic No: 3.2.2: Boric Acids:

11 What is reaction of heat on orthoboricacid, H_3BO_3? **(5 times)**
Ans: When orthoboric acid is heated strongly, it swells to frothy mass losing water-molecules. It is first converted into metaboric acid then to tetra boric acid and finally to boric anhydride.

$$H_3BO_3 \xrightarrow{100^\circ C} HBO_2 + H_2O$$
$$HBO_2 \xrightarrow{140^\circ C} H_2B_4O_7 + H_2O$$
$$H_2B_4O_7 \xrightarrow{Red.Hot} 2B_2O_3 + H_2O$$

12 Show that H_3BO_3 is monobasic acid? **(2 times)**

Ans: H_3BO_3 is a very weak acid and ionizes to a very limited extent mainly as a monobasic acid.

$$H_3BO_3 + H_2O \longrightarrow [B(OH)_4]^- + H^+$$

13 Boric acid can be converted to borax and vice versa. Give reactions? (4 times)

Ans: **Conversion of boric acid into borax:** Borax is prepared by treating a hot solution of boric acid with proper amount of soda ash:

$$4H_3BO_3 + Na_2CO_3 \longrightarrow Na_2B_4O_7 + 6H_2O + CO_2$$

Conversion of borax into boric acid:

Aqueous solution of borax reacts with HCl or H_2SO_4 to form boric acid.

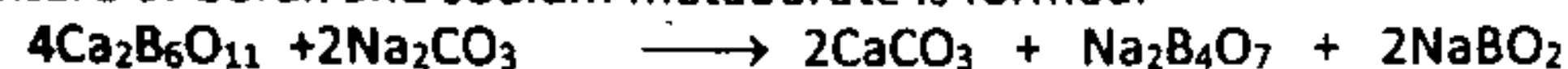
$$Na_2B_4O_7 + 2HCl + 5H_2O \longrightarrow 4H_3BO_3 + 2NaCl$$

$$Na_2B_4O_7 + H_2SO_4 + 5H_2O \longrightarrow 4H_3BO_3 + Na_2SO_4$$

14 How will you prepare Borax from "Colemanite" and "Boric acid"? (5 times)

Ans: **Preparation of Borax from "colemanite":**

Borax is almost exclusively obtained from calcium borate. Finely powdered colemanite is boiled with Na_2CO_3 solution. When $CaCO_3$ precipitates out and a mixture of borax and sodium metaborate is formed.

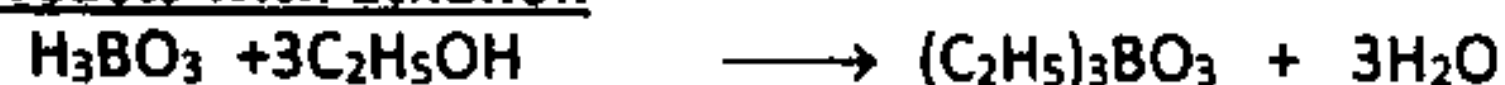
$$4Ca_2B_6O_{11} + 2Na_2CO_3 \longrightarrow 2CaCO_3 + Na_2B_4O_7 + 2NaBO_2$$

Preparation of Borax from "Boric acid":

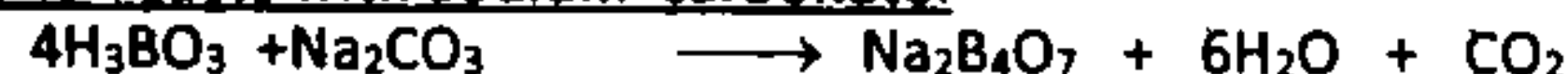
Borax is prepared by treating a hot solution of boric acid with proper amount of soda ash:

$$4H_3BO_3 + Na_2CO_3 \longrightarrow Na_2B_4O_7 + 6H_2O + CO_2$$

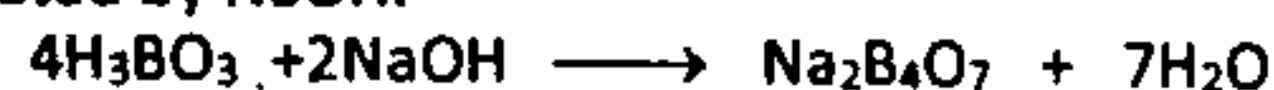
15 How does orthoboric reacts with; (i)Ethanol (ii)Sodium carbonate? (4 times)

Ans: **Orthoboric reacts with Ethanol:**

$$H_3BO_3 + 3C_2H_5OH \longrightarrow (C_2H_5)_3BO_3 + 3H_2O$$

Orthoboric reacts with Sodium carbonate:

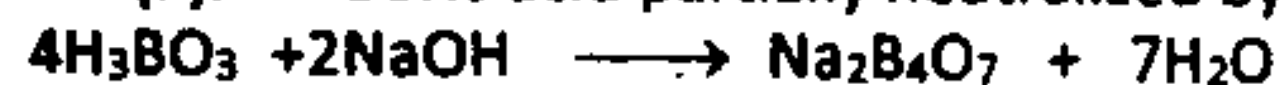
$$4H_3BO_3 + Na_2CO_3 \longrightarrow Na_2B_4O_7 + 6H_2O + CO_2$$

16 Why Boric acid cannot be titrated by NaOH?

Ans: Boric acid is partially neutralized by caustic soda to give borax so, boric acid cannot be titrated by NaOH.

$$4H_3BO_3 + 2NaOH \longrightarrow Na_2B_4O_7 + 7H_2O$$

17. How does H_3BO_3 act as an acid?

Ans: **(i).** Boric acid turns blue litmus red.

(ii). Boric acid partially neutralized by caustic soda to give borax.

$$4H_3BO_3 + 2NaOH \longrightarrow Na_2B_4O_7 + 7H_2O$$

18 Write down two (02) uses of boric acid. **(3 times)**

Ans: (i).Boric acid are used in medicines as an antiseptic, e.g. dusting powder, boric ointment and boric solution is used as an eye wash.

(ii). It is used in pottery as a glaze because borate glazes are more fusible than silicate glazes and possess a higher coefficient of thermal expansion.

Topic No: 3.3.1: Aluminium:

19 Write the behavior of Al with conc.HNO_3? **(2 times)**

Ans: Aluminium does not react with nitric acid at any concentration, probably because of the formation of protective layer of aluminium oxide.

20 Aluminium sheets are said to be corrosion free. Comment. **(2 times)**

Ans: When a sheet of aluminium is exposed to moist air it acquires a thin, continuous coating of alminium oxide, which prevents further attack on the metal by atmospheric oxygen and water under normal conditions. Because of this aluminium sheets are said to be corrosion-free.

21 Under what conditions aluminium corrodes? **(2 times)**

Ans: When aluminium sheet is exposed to moist air it acquires a thin, continuous coating of aluminium oxide, which is product of aluminium corrosion.

22 How Al finds its uses in metallurgy and photoflash bulbs?

Ans: **Uses of Al in metallurgy:**

Because of its ability to combine with both oxygen and nitrogen, the metal is often used to remove air bubbles from molten metals.

Uses of Al in photoflash bulbs:

Aluminium sheets are said to be corrosion-free. However, if the aluminum powder is heated to 800ºC and above, the metal will react with air to form aluminium oxide, and aluminium nitride, the reaction is accompanied by the evolution of heat and intense white light. This property of aliuminiumis made use in flash light photography.

$$4Al + 3O_2 \longrightarrow 2Al_2O_3$$

$$2Al + N_2 \longrightarrow 2AlN$$

23 Give reactions of Aluminium with dilute and concentrated H_2SO_4? (3 times)

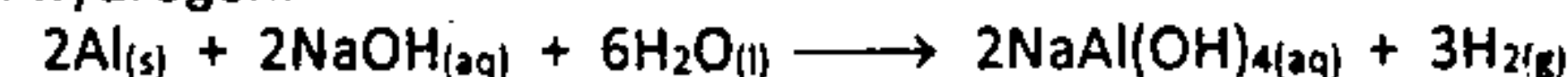
Ans: **Reactions with dilute H_2SO_4:** Aluminium does not react with dilute sulphuric acid.

Reactions with Conc. H_2SO_4: Al is oxidized by hot concentrated sulphuric acid to liberate sulphur dioxide gas.

$$2Al_{(s)} + 6H_2SO_{4(aq)} \longrightarrow Al_2(SO_4)_{3(aq)} + 6H_2O_{(l)} + 3SO_{2(g)}$$

24 In which way Al becomes water soluble by using NaOH?

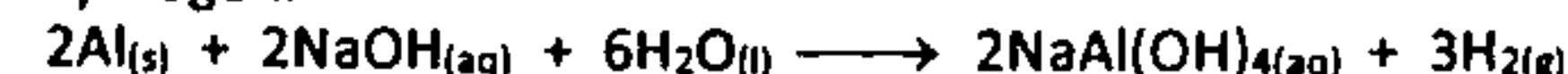
Ans: Aluminium dissolves in sodium hydroxide to form a soluble aluminate, with the evolution of hydrogen.

$$2Al_{(s)} + 2NaOH_{(aq)} + 6H_2O_{(l)} \longrightarrow 2NaAl(OH)_{4(aq)} + 3H_{2(g)}$$

25 Outline any four uses of aluminium? **(5 times)**

Ans:
- **(i).** It is non-magnetic and is thus used in navigational equipment.
- **(ii).** It is non toxic and can be used for making food and brewing equipments and in packaging.
- **(iii).** Aluminium readily forms alloys with other metals like copper, magnesium, nickel and zinc.
- **(iv).** At home, aluminium is found in the form of cooking utensils, window frames and kitchen foil.

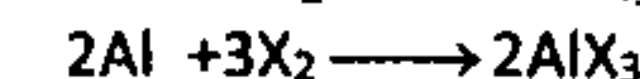
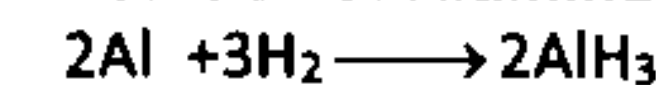
26 How Aluminium reacts with aqueous sodium hydroxide?

Ans: Aluminium dissolves in sodium hydroxide to form a soluble aluminate, with the evolution of hydrogen.

$$2Al_{(s)} + 2NaOH_{(aq)} + 6H_2O_{(l)} \longrightarrow 2NaAl(OH)_{4(aq)} + 3H_{2(g)}$$

27 How Al reacts with Hydrogen and halogen?

Ans: **Reaction of Aluminum:**

$$2Al + 3H_2 \longrightarrow 2AlH_3$$

$$2Al + 3X_2 \longrightarrow 2AlX_3$$

Topic No: 3.4: Group IVA Elements (Carbon and Silicon):

28 Write two points to show peculiar behavior of carbon.

Ans: Carbon differs from remaining members of group IV-A in the following respects;

(i). Carbon and silicon are nonmetals while the other members of the family are metalloids or metals.

(ii). Catenation or self linkage property of carbon to form long chain of identical atoms.

29 Give four common properties of group IVA elements of periodic table.

Ans: (i).All the elements of this group show a valency of four.

(ii). All of them form hydrides, MH_4.

(iii). They form tetrachlorides, MCl_4.

(iv). They also form the oxides, MO_2.

30 Give two similarities between carbon and silicon. **(2 times)**

Ans: **(i)** Carbon and silicon both form acidic oxides whereas other oxides of other members are amphoteric in nature.

Both carbon and silicon form covalent bonds. Their oxides are acidic and both form hydrides and chlorides.

31 In what respects, carbon behaves differently from other members of group IV-A?

Ans: Carbon differs from the remaining members of Group IVA in following respects;

Carbon and silicon are non-metals while the other members of the family are metalloids or metals.

Catenation or self -linkage of identical atoms with each other is called catenation or self-linkage. The property of catenation decreases on moving down the group from carbon to lead. The maximum tendency of catenation associated with carbon forms the basis of the carbon compounds which constitute organic chemistry.

LONG QUESTIONS OF CHAPTER-3 GROUP IIIA AND GROUP IVA ELEMENTS ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 3.1

1. Describe four points of peculiar behavior of Boron.

Ans: (Text Book Page No:39)

Topic No: 3.2.1

2. Explain that aqueous solution of borax is alkaline in nature.

Ans: (Text Book Page No:42)

3. Write two preparations and two chemical reactions of Borax.

Ans: (Text Book Page No:39)

4. Write down two methods for the preparation of borax. Also explain the action of heat on borax. **(2 times)**

Ans: (Text Book Page No:39)

5. Explain borax bead test with its chemistry

Ans: (Text Book Page No:41)

Topic No: 3.2.2

6. How will you convert boric acid into borax and vice versa?

Ans: (Text Book Page No:41)

7. Give one method for the preparation of H_3BO_3. How does it react with C_2H_5OH, $NaOH$, Na_2CO_3.

Ans: (Text Book Page No:42)

8. Discuss effect of heat on boric acid

Ans: (Text Book Page No:42)

9. What is boric acid? Give its properties.

Ans: (Text Book Page No:41+42)

Topic No: 3.3

10. How and under what conditions does aluminium react with : (i) O_2 (ii) $NaOH$ (iii) H_2SO_4 (iv) N_2

Ans: (Text Book Page No:43)

OBJECTIVES (MCQ'S) OF CHAPTER-4 GROUP VA AND GROUP VIA ELEMENTS ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 4.1: Introduction: (Group VA Elements):

1. Among group VA elements, the most electronegative is: (4 times)

(a)Sb (b)N (c)P (d) As

2. Out of all the elements of group VI-A the highest melting and boiling points is shown by the elements. (2 times)

(a)Te (b) Se (c)S (d)Po

3. A gas which burns with blue flame is:

(a) CO_2 (b) NO (c) CO (d) N_2

4. Laughing gas is chemically: (14 times)

(a) NO (b) NO_2 (c) N_2O (d) N_2O_4

5. Which of the following species has the maximum number of unpaired electrons? (7 times)

(A) O_2 (B) O_2^+ (C) O_2^- (D) O_2^{-2}

6. Which of the following elements is not present abundantly in earth crust?

(a) Calcium (b) Sodium (c) Phosphorous (d) Nitrogen

7. Point out the element whose inorganic minerals are not much abundant in earth crust:

(a) Li (b) N (c) Na (d) O

8- Out of all the elements of group VA, the highest Ionization Energy is possessed by:

(a) N (b) P (c) Sb (d) Bi

Topic No: 4.2.2: Oxides of Nitrogen:

9. Oxidation of NO in air produces: (8 times)

(a) NO_2 (b) N_2O_3 (c) N_2O_4 (d) N_2O_5

10. NO_2 is called:

(a)Nitrogen dioxide (b) Nitrous oxide (c)Nitric oxide (d)Nitric anhydride

11. If N_2O is exposed to a person it causes disease:

(a)Cancer (b) Sleeping sickness (c)Hysterical laughter (d)Tumor

Topic No: 4.2.3: Oxyacids of Nitrogen:

12. Which of the following is a reddish brown gas, when metal reduces HNO_3? (3 times)

(a) N_2O (b) NO (c) N_2O_5 (d) NO_2

13. The brown gas formed when metal reduces HNO_3 is: (6 times)

(a) N_2O_5 (b) N_2O_3 (c) NO_2 (d)NO

Topic No: 4.3: Phosphorus and its Compounds:

14. Which catalyst is used in contact process for manufacture of H_2SO_4? (12 times)

(a) Fe_2O_3 (b) V_2O_5 (c) Al_2O_3 (d) MnO_2

15. The most reactive allotropic form of phosphorus is:

(a) White (b) Red (c)Black (d)None of these

2019

16. Maximum electronegative character is present in

(a) Sb (b) N (c) P (d) Si

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

1	2	3	4	5	6	7	8	9	10
B	D	C	C	A	D	B	A	A	A
11	12	13	14	15	16				
C	D	C	B	A	B				

SHORT QUESTIONS OF CHAPTER-4
GROUP VA AND GROUP VIA ELEMENTS
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 4.2: Nitrogen and its compounds:

1 Why Nitrogen is chemically inert at room temperature?

Ans: Nitrogen has five electrons in its outermost shell, it form triple bond with other nitrogen to complete its octet. So nitrogen molecule is stable molecule. It does not react under ordinary conditions. It is chemically inert at room temperature

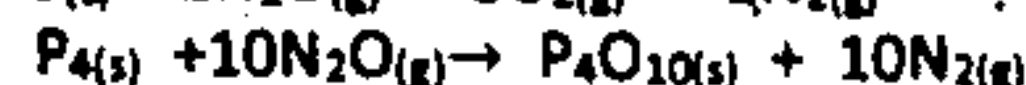
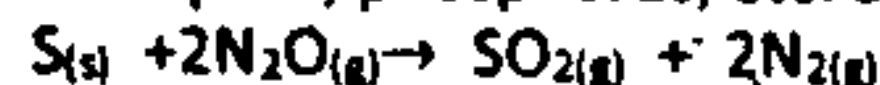
2 Why Dinitrogen Oxide is called "laughing gas"?

Ans: Its mixture with a little oxygen, if inhaled for a sufficiently long time, produces hysterical laughter, hence it is also known as "laughing gas".

3 "N_2O supports combustion" Give two reactions in favour of the statement? (4 times)

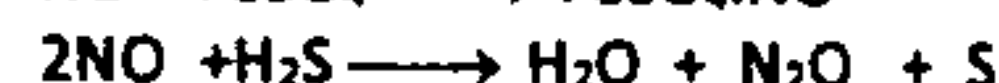
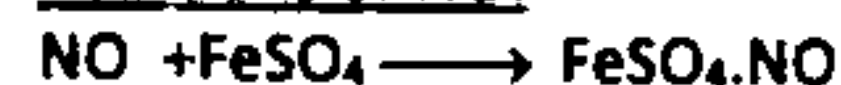
Ans: **N₂O supports combustion:** It supports combustion if burning substances, such as sulphur, phosphorus, etc. are taken in the cylinder containing this gas.

$S_{(s)} + 2N_2O_{(g)} \rightarrow SO_{2(g)} + 2N_{2(g)}$

$P_{4(s)} + 10N_2O_{(g)} \rightarrow P_4O_{10(s)} + 10N_{2(g)}$

4. Write two reactions of NO with (a) $FeSO_4$ (b) H_2S (2 times)

Ans: **Reactions of NO:**

$NO + FeSO_4 \longrightarrow FeSO_4.NO$

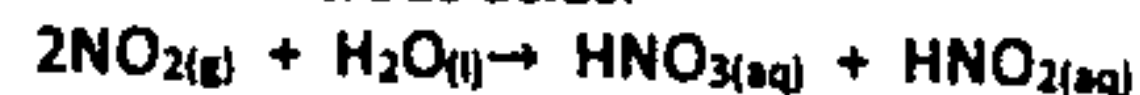
$2NO + H_2S \longrightarrow H_2O + N_2O + S$

5 Complete and balance the equations: (a) $FeSO_4(ab)+NO(g) \Rightarrow$ (b) $NO+Cl_2 \Rightarrow$

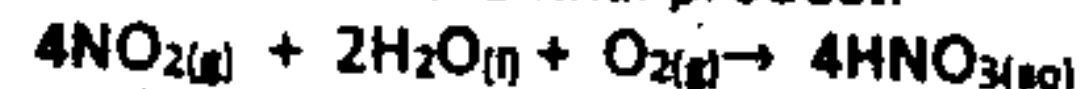
Ans: (a) $FeSO_{4(aq)} + NO_{(g)} \longrightarrow FeSO_4.NO_{(aq)}$

(b) $2NO_{(g)} + Cl_{2(g)} \longrightarrow 2NOCl_{(g)}$

6 What happens when NO_2 is dissolved in water? (2 times)

Ans: (i). **In the absence of oxygen:** In the absence of air, it dissolves in water to form nitric and nitrous acids.

$2NO_{2(g)} + H_2O_{(l)} \rightarrow HNO_{3(aq)} + HNO_{2(aq)}$

(ii). **In the presence of oxygen:** In the presence of air or oxygen, it dissolves in water and nitric is the final product.

$4NO_{2(g)} + 2H_2O_{(l)} + O_{2(g)} \rightarrow 4HNO_{3(aq)}$

7 Write names and formulas of oxyacids of nitrogen.

Ans:

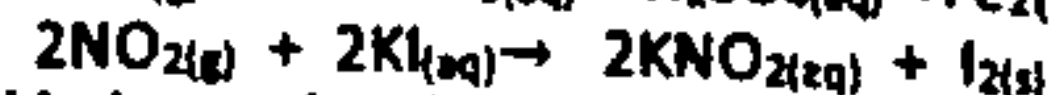
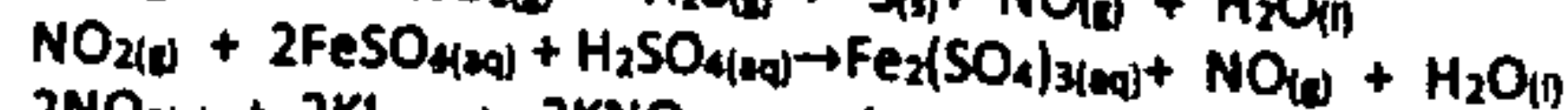
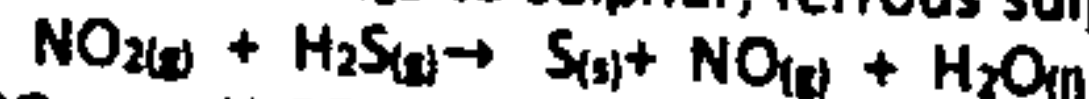
	Name	Formula
1.	Nitrous Acid	HNO_2
2.	Nitric Acid	HNO_3

8 NO_2 is strong oxidizing agent. Prove with help of two chemical reactions?

Ans: It is strong oxidizing agent and oxidizes H_2S to sulphur, ferrous sulphate to ferric sulphate and KI to I_2.

$NO_{2(g)} + H_2S_{(g)} \rightarrow S_{(s)} + NO_{(g)} + H_2O_{(l)}$

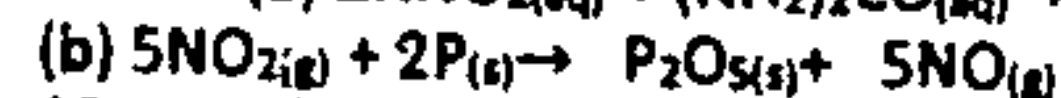
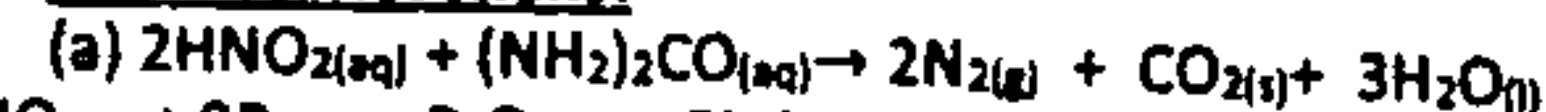
$NO_{2(g)} + 2FeSO_{4(aq)} + H_2SO_{4(aq)} \rightarrow Fe_2(SO_4)_{3(aq)} + NO_{(g)} + H_2O_{(l)}$

$2NO_{2(g)} + 2KI_{(aq)} \rightarrow 2KNO_{2(aq)} + I_{2(s)}$

9 Complete and balance the given equations: (2 times)

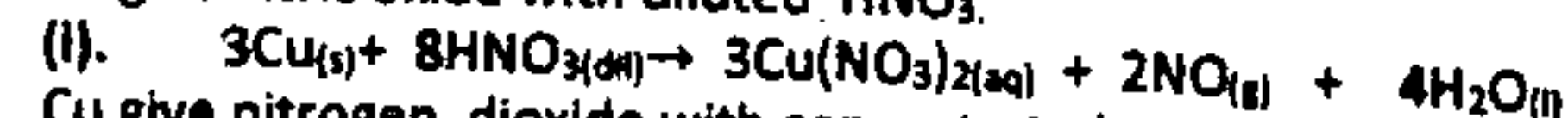
(a) $HNO_2 + (NH_2)_2CO \rightarrow$? (b) $NO_2 + P \rightarrow$?

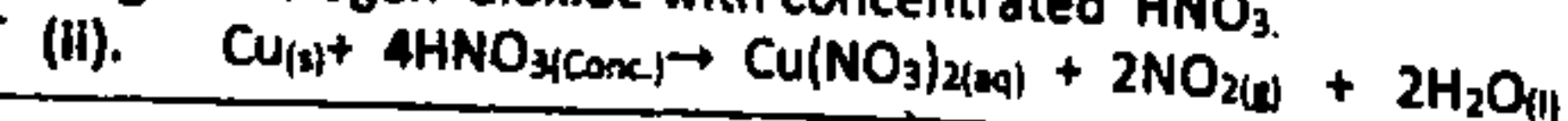
Ans: **Chemical Reactions:**

(a) $2HNO_{2(aq)} + (NH_2)_2CO_{(aq)} \rightarrow 2N_{2(g)} + CO_{2(s)} + 3H_2O_{(l)}$

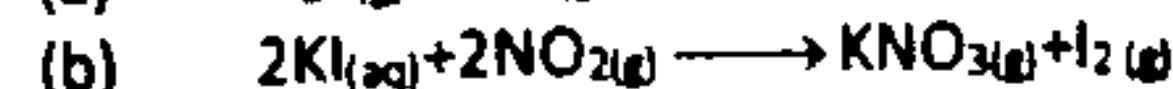
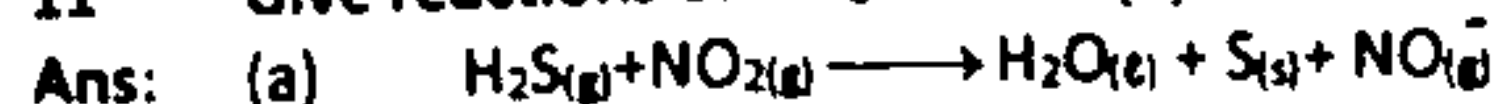
(b) $5NO_{2(g)} + 2P_{(s)} \rightarrow P_2O_{5(s)} + 5NO_{(g)}$

10 Give reaction of Cu with dil. HNO_3 and conc. HNO_3. (2 times)

Ans: Cu give nitric oxide with diluted HNO_3.

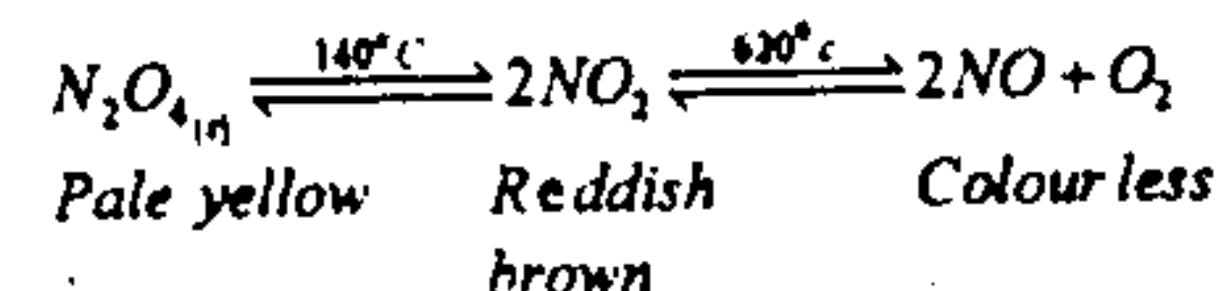
(i). $3Cu_{(s)} + 8HNO_{3(dil)} \rightarrow 3Cu(NO_3)_{2(aq)} + 2NO_{(g)} + 4H_2O_{(l)}$

Cu give nitrogen dioxide with concentrated HNO_3.

(ii). $Cu_{(s)} + 4HNO_{3(Conc.)} \rightarrow Cu(NO_3)_{2(aq)} + 2NO_{2(g)} + 2H_2O_{(l)}$

11 Give reactions of NO_2 with (a) H_2S (b) KI

Ans: (a) $H_2S_{(g)} + NO_{2(g)} \longrightarrow H_2O_{(l)} + S_{(s)} + NO_{(g)}$

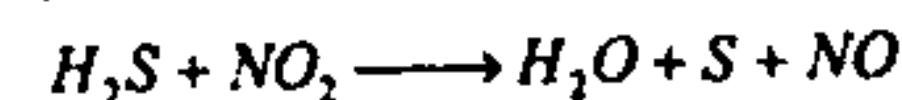
(b) $2KI_{(aq)} + 2NO_{2(g)} \longrightarrow KNO_{3(g)} + I_{2(g)}$

12. How temperature affects gaseous NO_2.

Ans: On cooling NO_2 is converted to a yellow liquid which can be frozen to N_2O_4. If this solid is heated to 140°C the mixture contains NO_2 and N_2O_4 but above 140°C, NO_2 is converted to NO and O_2.

$$\underset{\text{Pale yellow}}{N_2O_{4(l)}} \xrightleftharpoons{140^\circ C} \underset{\text{Reddish brown}}{2NO_2} \xrightleftharpoons{620^\circ C} \underset{\text{Colour less}}{2NO + O_2}$$

13. Prove that NO_2 is strong oxidizing agent.

Ans: NO_2 oxidizes H_2S to Sulphur and KI to Iodine.

$$H_2S + NO_2 \longrightarrow H_2O + S + NO$$

$$2KI + 2NO_2 \longrightarrow 2KNO_2 + I_2$$

These reactions prove that NO_2 is strongly oxidizing agent.

Topic No: 4.2.3: Oxyacids of Nitrogen:

14 Write any four uses of nitric acid? (2 times)

Ans: (i). It is used as laboratory reagent.

(ii). It is used in manufacturing of explosives.

(iii). It is used in manufacturing of nitrogen fertilizers.

(iv). It is used to make varnishes and organic dyes.

15 Write structure of N_2O and NO_2?

Ans: (i). Structure of dinitrogen oxide (N_2O) : $\left[\bar{N} = \dot{N} = O \leftrightarrow N \equiv \dot{N} - \bar{O} \right]$

(ii). Structure of nitrogen dioxide (NO_2) : $\left[\ddot{O} = N - \ddot{O}^- \right]$

16 How NO acts as reducing agent? Give two examples.

Ans: **NO as reducing agent:**

When NO reacts with an oxidizing agent it converts to NO_2. Here it act as reducing agent.

1. $2HNO_3(conc.) + NO_{(aq)} \rightarrow H_2O_{(aq)} + 3NO_{2(g)}$

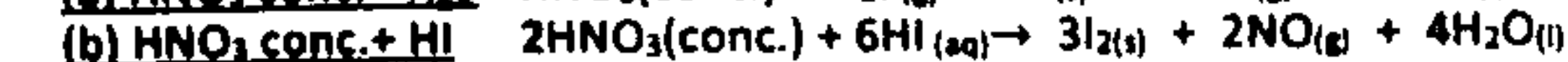
Also,

2. $10NO_{(aq)} + 6KMnO_{4(aq)} + 12H_2SO_{4(aq)} \rightarrow 6KHSO_{4(aq)} + 6MnSO_{4(aq)} + 10HNO_{3(aq)} + 4H_2O_{(l)}$

17 Complete the following reactions:

(a) HNO_3 conc.+H_2S (b) HNO_3 conc.+ HI

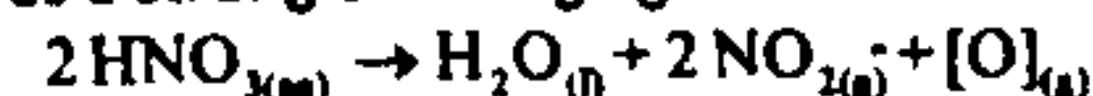
Ans: **(a) HNO₃ conc.+ H₂S** $HNO_3(conc.) + H_2S_{(g)} \rightarrow 3S_{(s)} + 2NO_{(g)} + 4H_2O_{(l)}$

(b) HNO₃ conc.+ HI $2HNO_3(conc.) + 6HI_{(aq)} \rightarrow 3I_{2(s)} + 2NO_{(g)} + 4H_2O_{(l)}$

18 How does HNO_3 act as an oxidizing agent? (5 times)

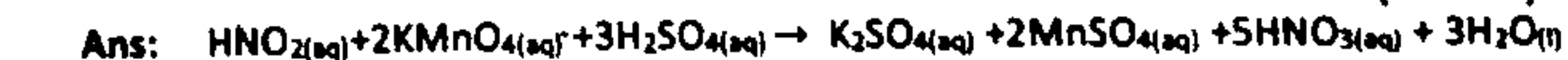
Ans: **Action of HNO₃ as an oxidizing agent:**

It acts as a strong oxidizing agent due to the ease with which it is decomposed.

$$2HNO_{3(aq)} \rightarrow H_2O_{(l)} + 2NO_{2(g)} + [O]_{(g)}$$

$$C + 4HNO_3 \rightarrow CO_2 + 4NO_2 + 2H_2O$$

19 Nitrous acid decolourizes acidified $KMnO_4$ and bromine water. Give reactions. (2 times)

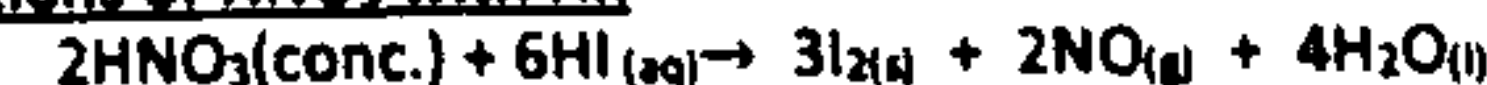
Ans: $HNO_{2(aq)} + 2KMnO_{4(aq)} + 3H_2SO_{4(aq)} \rightarrow K_2SO_{4(aq)} + 2MnSO_{4(aq)} + 5HNO_{3(aq)} + 3H_2O_{(l)}$

$HNO_{2(aq)} + Br_{2(aq)} + H_2O_{(l)} \rightarrow K_2SO_{4(aq)} + 2HBr_{(aq)} + HNO_{3(aq)}$

20 Write balanced equation for reactions of HNO_3 with: (a) HI (b) $CO(NH_2)_2$

Ans: **Reactions of HNO₃ with HI:**

$2HNO_3(conc.) + 6HI_{(aq)} \rightarrow 3I_{2(s)} + 2NO_{(g)} + 4H_2O_{(l)}$

Reactions of HNO₃ with CO(NH₂)₂:

$(NH_2)_2CO\ (aq) + HNO_3\ (aq) \rightarrow (NH_2)_2COHNO_3\ (s)$

21 How HNO_3 can be prepared in the laboratory?

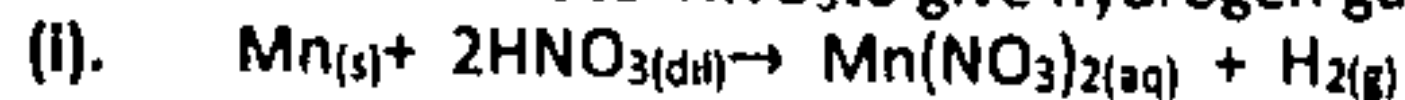
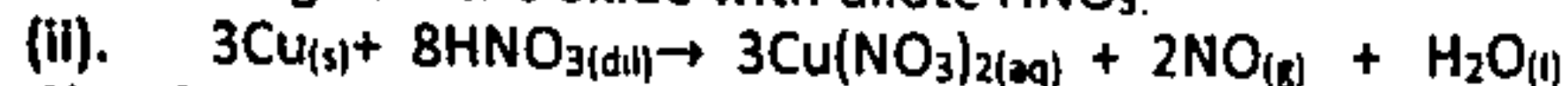
Ans: In laboratory, nitric acid is prepared by heating potassium nitrate crystals with concentrated sulphuric acid. $KNO_{3(s)} + H_2SO_{4(conc.)} \rightarrow KHSO_{4(aq)} + HNO_{3(aq)}$

22 How does dilute HNO_3 react with Mn and Cu?

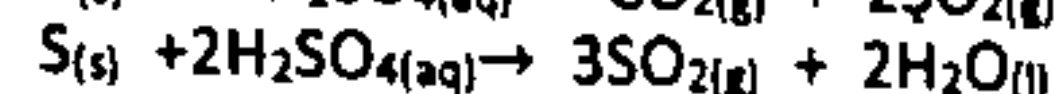
Ans: Mn reacts with dilute HNO_3 to give hydrogen gas.

(i). $Mn_{(s)} + 2HNO_{3(dil)} \rightarrow Mn(NO_3)_{2(aq)} + H_{2(g)}$

Cu give nitric oxide with dilute HNO_3.

(ii). $3Cu_{(s)} + 8HNO_{3(dil)} \rightarrow 3Cu(NO_3)_{2(aq)} + 2NO_{(g)} + H_2O_{(l)}$

23 Give the reactions of HNO_3 with carbon and sulphur?

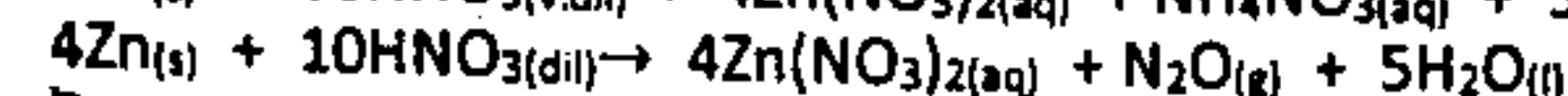
Ans: $C_{(s)} + 2H_2SO_{4(aq)} \rightarrow CO_{2(g)} + 2SO_{2(g)} + 2H_2O_{(l)}$

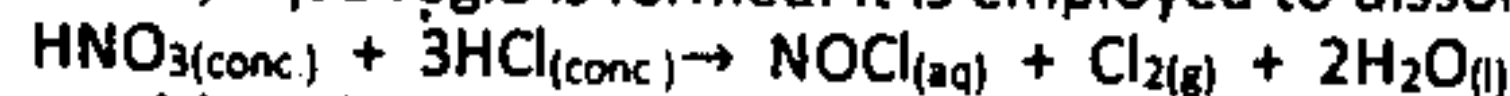
$S_{(s)} + 2H_2SO_{4(aq)} \rightarrow 3SO_{2(g)} + 2H_2O_{(l)}$

24 Write reactions of Nitric acid with Zinc?

Ans: Zinc give different products depending upon the concentration of acid and temperature. Very dilute nitric acid gives NH_4NO_3. Moderately diluted nitric acid gives nitrous oxide while concentrated nitric acid gives NO_2.

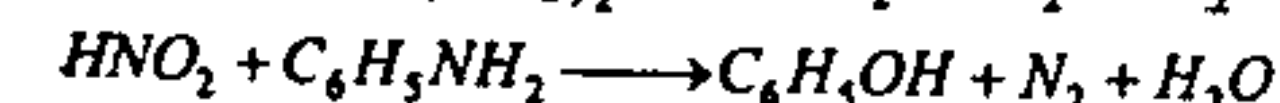
$4Zn_{(s)} + 10HNO_{3(v.dil)} \rightarrow 4Zn(NO_3)_{2(aq)} + NH_4NO_{3(aq)} + 3H_2O_{(l)}$

$4Zn_{(s)} + 10HNO_{3(dil)} \rightarrow 4Zn(NO_3)_{2(aq)} + N_2O_{(g)} + 5H_2O_{(l)}$

$Zn_{(s)} + 4HNO_{3(conc.)} \rightarrow 4Zn(NO_3)_{2(s)} + 2NO_{2(g)} + 2H_2O_{(l)}$

25 What is aqua-regia? **(6 times)**

Ans: **Aqua Regia:** When one volume of concentrated HNO_3 is mixed with three volume of concentrated HCl, aqua regia is formed. It is employed to dissolve gold and platinum. $HNO_{3(conc.)} + 3HCl_{(conc.)} \rightarrow NOCl_{(aq)} + Cl_{2(g)} + 2H_2O_{(l)}$

26. How nitrous acid reacts with $CO(NH_2)_2$ and $C_6H_5NH_2$.

Ans: $2HNO_2 + CO(NH_2)_2 \longrightarrow 2N_2 + CO_2 + 3H_2O$

$HNO_2 + C_6H_5NH_2 \longrightarrow C_6H_5OH + N_2 + H_2O$

Topic No: 4.3: Phosphorus and its Compounds:

27 Write the formulas of (a) Phosphorite (b) Chile saltpeter.

Ans: (a) Phosphorite: $Ca_3(PO_4)_2$ (b) Chile saltpeter : $NaNO_3$

Topic No: 4.3.2: Allotropes of Phosphorus:

28 Name three allotropic forms of phosphorous?

Ans: **Allotropic forms of phosphorous:** Phosphorus can exist in at least six different solid allotropic forms. But here mentioned only three.

(i). White phosphorus (P_4) (ii). Red phosphorus (macromolecule of P_4)

(iii). Black phosphorus (high temperature heating of red P)

29 Give molecular structure of red phosphorous. How it is prepared form white phosphorous?

Ans: **Molecular structure of red phosphorous:**

30 Give definition of allotropy. Write allotropes of phosphorus.

Ans: **Definition:** When an element exist in different crystalline forms. These crystalline forms are called allotropic forms and this phenomenon is called allotropy.

Allotropic forms of phosphorous: Phosphorus can exist in at least six different solid allotropic forms. But here mentioned only three.

(i). White phosphorus (P_4) (ii). Red phosphorus (macromolecule of P_4)

(iii). Black phosphorus (high temperature heating of red P)

Topic No: 4.4.3: Occurrence of Sulphur:

31 Write two dissimilarities of oxygen and sulphur? **(5 times)**

Ans: **Dissimilarities of oxygen and sulphur:**

	Oxygen	Sulphur
1	It is gas at ordinary temperature.	It is solid at ordinary temperature.
2	Oxygen is sparingly soluble in water.	Sulphur is not soluble in water.
3	It is paramagnetic in nature.	It is diamagnetic in nature.

32 How does sulphur occur in nature?

Ans: **Occurrence of Sulphur:**

Sulphur is widely distributed in nature both as free and combined forms. Many important metallic ores are sulphides, e.g. galena (PbS), Zinc Blende (ZnS), cinnabar (HgS), stibnite (Sb_2S_3), copper pyrite (Cu_2S. Fe_2S_3), iron pyrite (FeS_2). Sulphur also occur in organic compounds present in animals and vegetables. Onion, garlic, mustard, hair, many oils, egg and proteins consists of compounds containing sulphur in them. It also occur as a constituent of coal and petroleum.

Topic No: 4.5.1: Manufacture of Sulphuric Acid:

33 State the principle of contact process for manufacture of sulphuric acid?

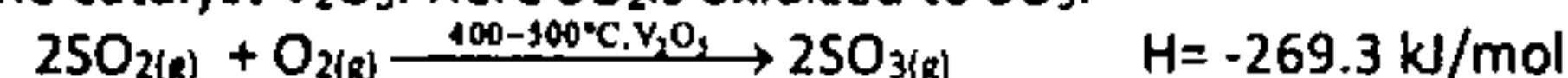
Ans: (i). SO_2 obtained by burning sulphur or iron pyrites is oxidized to SO_3 in the presence of V_2O_5 which acts as a catalyst.

(ii). The best yield of SO_3 can be obtained by using excess of oxygen or air and keeping the temperature between 400-500ºC.

(iii). SO_3 is absorbed in concentrated H_2SO_4 and "Oleum"($H_2S_2O_7$) formed can be converted to sulphuric acid of any strength by mixing adequate quantities of water.

34 Write the chemical reactions which takes place in contact chamber?

Ans: Pre-heated gases at 400-500ºC are passed through vertical iron columns packed with the catalyst V_2O_5. Here SO_2 is oxidized to SO_3.

$2SO_{2(g)} + O_{2(g)} \xrightarrow{400-500^\circ C, V_2O_5} 2SO_{3(g)}$ H= -269.3 kJ/mol

Reaction is highly exothermic so no heating is required once reaction is started.

35 What are the optimum condition for the manufacture of H_2SO_4 in the contact process? **(2 times)**

Ans: (i). **Catalyst:** SO_2 obtained by burning sulphur or iron pyrites is oxidized to SO_3 in the presence of V_2O_5 which acts as a catalyst.

(ii). **Temperature:** The best yield of SO_3 can be obtained by using excess of oxygen or air and keeping the temperature between 400-500ºC.

(iii). **Absorbing:** SO_3 is absorbed in concentrated H_2SO_4 and "Oleum"($H_2S_2O_7$) formed can be converted to sulphuric acid of any strength by mixing adequate quantities of water.

36 Give reactions of contact process for the manufacturing of Sulphuric acid.

Ans: **Reactions of contact process:**

Sulphur Burner:

$S_{(s)} + O_{2(g)} \longrightarrow SO_{2(g)}$

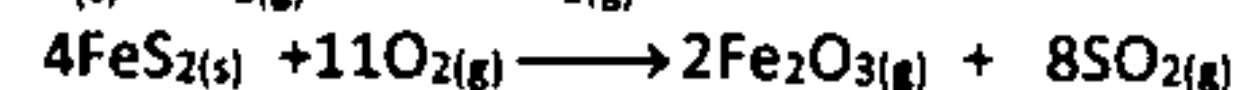
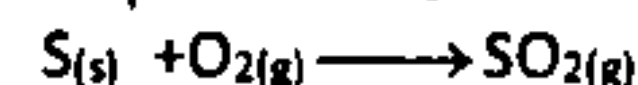
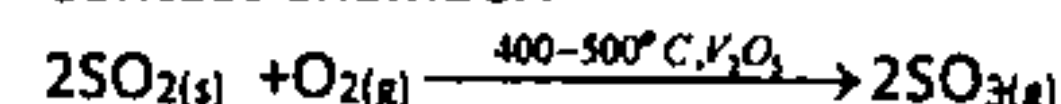
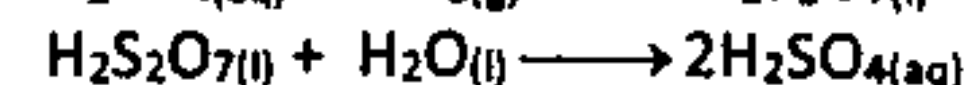
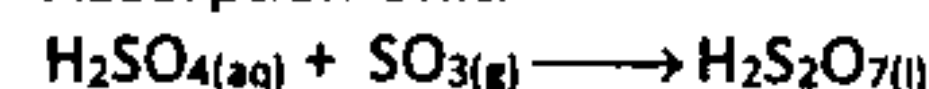
$4FeS_{2(s)} + 11O_{2(g)} \longrightarrow 2Fe_2O_{3(g)} + 8SO_{2(g)}$

Contact Chamber:

$2SO_{2(s)} + O_{2(g)} \xrightarrow{400-500^\circ C, V_2O_5} 2SO_{3(g)}$

Absorption Unit:

$H_2SO_{4(aq)} + SO_{3(g)} \longrightarrow H_2S_2O_{7(l)}$

$H_2S_2O_{7(l)} + H_2O_{(l)} \longrightarrow 2H_2SO_{4(aq)}$

Topic No: 4.5.2: Reactions of Sulphuric Acid:

37 Write two reactions in which sulphuric acid acts as a dehydrating agent? **(8 times)**

Ans: H_2SO_4 has great affinity for water, so it act as dehydrating agent and eliminates water from different compounds.

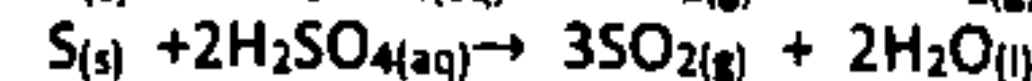
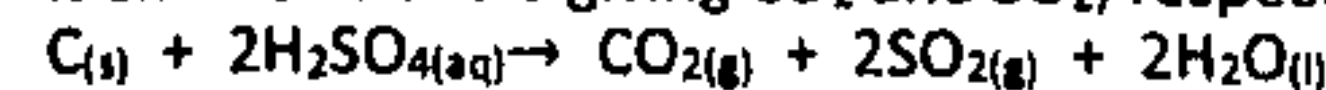
(i). with formic acid CO is formed. $HCOOH_{(aq)} \xrightarrow{Conc\ H_2SO_4} CO_{(g)} + H_2O_{(l)}$

(ii). with ethyl alcohol it forms ethylene. $C_2H_5OH_{(aq)} \xrightarrow{Conc\ H_2SO_4} C_2H_{4(g)} + H_2O_{(l)}$

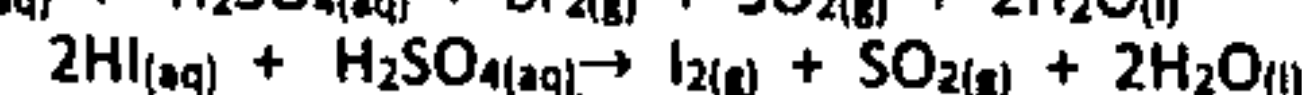
38 How sulphuric acid act as an oxidizing agent? **(5 times)**

Ans: (i). It oxidizes C and S giving CO_2 and SO_2, respectively.

$C_{(s)} + 2H_2SO_{4(aq)} \rightarrow CO_{2(g)} + 2SO_{2(g)} + 2H_2O_{(l)}$

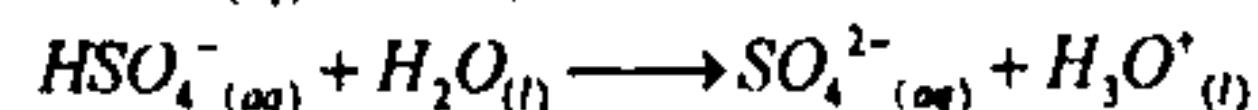
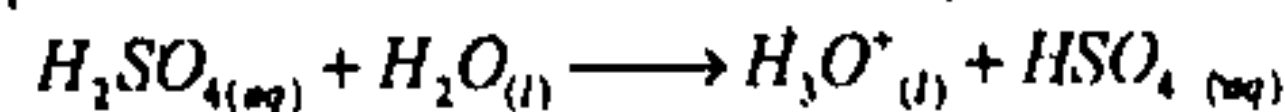
$S_{(s)} + 2H_2SO_{4(aq)} \rightarrow 3SO_{2(g)} + 2H_2O_{(l)}$

(ii). H_2S is oxidize to S: $H_2S_{(g)} + 2H_2SO_{4(aq)} \rightarrow S_{(s)} + SO_{2(g)} + 2H_2O_{(l)}$

(iii). Reaction of H_2SO_4 with HBr and HI produces bromine and iodine respectively. $2HBr_{(aq)} + H_2SO_{4(aq)} \rightarrow Br_{2(g)} + SO_{2(g)} + 2H_2O_{(l)}$

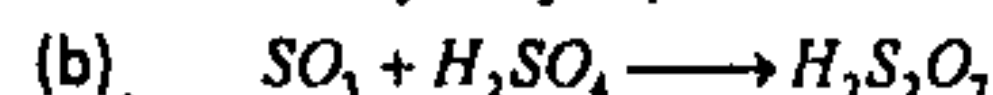
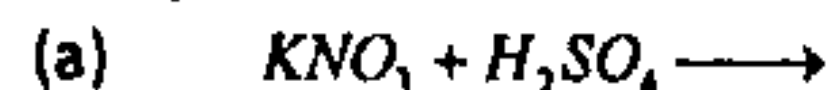
$2HI_{(aq)} + H_2SO_{4(aq)} \rightarrow I_{2(g)} + SO_{2(g)} + 2H_2O_{(l)}$

39 H_2SO_4 behaves as an Acid. Write two reactions to illustrate the truth.

Ans: It is a strong acid. In an aqueous solution it completely ionizes to give hydronium and sulphate ions the dissociation takes place in two steps:

$$H_2SO_{4(aq)} + H_2O_{(l)} \longrightarrow H_3O^+_{(l)} + HSO_4{}_{(aq)}$$

$$HSO_4^-{}_{(aq)} + H_2O_{(l)} \longrightarrow SO_4^{2-}{}_{(aq)} + H_3O^+_{(l)}$$

40. Complete and balance following equations.

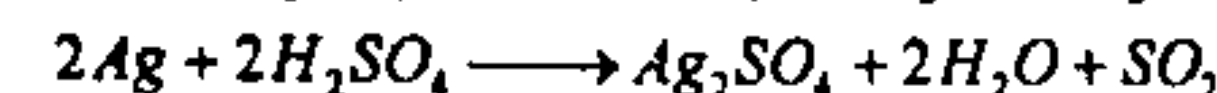
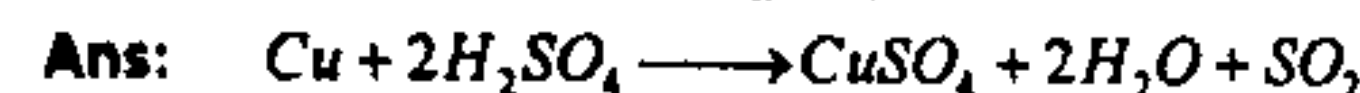
(a) $KNO_3 + H_2SO_4 \longrightarrow$

(b) $SO_3 + H_2SO_4 \longrightarrow H_2S_2O_7$

Ans: (a) $KNO_3 + H_2SO_4 \longrightarrow KHSO_4 + HNO_3$

(b) $SO_3 + H_2SO_4 \longrightarrow H_2S_2O_7$

41. How hot conc. H_2SO_4 reacts with Cu and Ag metals.

Ans: $Cu + 2H_2SO_4 \longrightarrow CuSO_4 + 2H_2O + SO_2$

$2Ag + 2H_2SO_4 \longrightarrow Ag_2SO_4 + 2H_2O + SO_2$

Topic No: 4.5.3: Uses of Sulphuric Acid:

42 Justify that H_2SO_4 is a king of chemicals?

Ans: H_2SO_4has many applications in daily life, laboratories, industries etc. What's common to petrol, fertilizers, cars and soaps? They, like a lot of other things, require sulfuric acid to be made. That's why sulfuric acid is called the king of chemicals.

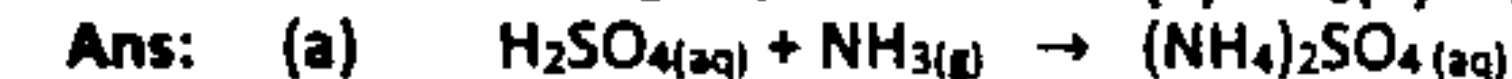
43 Write any four important uses of H_2SO_4? (9 times)

Ans: (i). It is used in manufacturing of fertilizers like ammonium sulphate and calcium superphosphate.

(ii). It is used in refining of petroleum to remove nitrogen and sulphur compounds.

(iii). It is used in manufacturing of HCl, H_3PO_4, HNO_3 and sulphates.

(iv). It is used in electrical batteries and storage cells.

44 How does H_2SO_4 reacts with (a) NH_3(b) H_2S

Ans: (a) $H_2SO_{4(aq)} + NH_{3(g)} \rightarrow (NH_4)_2SO_{4(aq)}$

(b) $H_2S_{(g)} + H_2SO_{4(aq)} \rightarrow S_{(s)} + SO_{2(g)} + 2H_2O_{(g)}$

LONG QUESTIONS OF CHAPTER-4 GROUP VA AND GROUP VIA ELEMENTS ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 4.2.3/2

1 What happen when dil HNO_3 and conc. HNO_3 react with following?

(i) Cu (ii) Hg (iii) Sn (iv) Zn

Ans: (Text Book Page No:62)

2. Explain Birkeland and Eyde's process for preparation of HNO_3. (3 times)

Ans: (Text Book Page No:61)

3. How is nitric acid prepared industrially? Give all equations involved.

Ans: (Text Book Page No:61)

Topic No: 4.4.3

4. Describe eight points of similarities of oxygen with sulphur.

Ans: (Text Book Page No:69)

Topic No: 4.5

5. How sulphuric acid is manufactured by contact process on industrial scale?

Ans: (Text Book Page No:70)

OBJECTIVES (MCQ'S) OF CHAPTER-5 HALOGENS AND THE NOBLE GASES ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 5.1: Introduction:

1. The element which causes burn to skin that heels slowly:
(a) F_2 (b) Cl_2 (c) Br_2 (d) Acidic

2- Melting points of halogens------ the group.
(A) Decrease down (B) Increase down
(C) Remain same throughout (D) First increase then decrease down (23 times)

3.Which of the following statement is correct?
(a) Bond energy of I_2 is less than Cl_2 (b) Bond energy of F_2 is less than I_2
(c) Bond energy of Cl_2 is less than F_2 (d) Bond energy of Cl_2 is greater than I_2:

4.Which halogen is used as an insecticide?
(a) Br_2 (b) I_2 (c) Cl_2 (d) F_2

5- Out of elements of group VII-A , the highest melting and boiling points is shown by element:
(a) F_2 (b)I_2 (c)Cl_2 (d) Br_2

6-Which one of halogens is a liquid?
(a) F_2 (b)Cl_2 (c)Br_2 (d) I_2

7- The radius of F^- ion is:
(a) 72pm (b) 136 pm (c)99pm (d) 181pm

Topic No: 5.5.1: Hydrides:

8. Which halogen acid is the weakest acid in its aqueous solution: (2 times)
(a)HF (b) HCl (c)HBr (d) HI

9. Which of the following hydrogen halide is the weakest acid in solution? (7 times)
(a)HF (b) HCl (c) HBr (d) HI

10.Which of the following is the strongest acid in solution? (7 times)
(a)HF (b) HCl (c)HBr (d)HI

11- Hydrogen bond is strongest between the molecule of: (2 times)
(a) HI (b)HBr (c)HF (d) HCl

12. Which halogen occurs naturally in a positive oxidation state: (10 times)
(a)Florine (b) Chlrine (c) Bomine (d) Iodine

Topic No: 5.5.2: Oxides of Halogens:

13. ClO_2 react with H_2O to form: (2 times)
(a) HClO (b) $HClO_3$ (c) $HClO_4$ (d) Cl_2 and O_2

14. Bond angle in OF_2 is:
(a) 180° (b) 120° (c) 107° (d) 105°

15. Iodine penta oxide (I_2O_5) is used for the quantitative analyses of:
(a) I_2 (b) CO (c) CO_2 (d) H_2S

16- Chlorine heptaoxide (Cl_2O_7) reacts with water to from: (2 times)
(a) Hypochlorous acid (b) Perchloric acid (c) Chloric acid (d) Chlorine and oxygen

Topic No: 5.5.4: Oxyacids:

17. The halogen that does not form oxyacids is:
(a) Fluorine (b) Chlorine (c) Bromine (d) Iodine

18.The anhydride of $HClO_4$ is: (5 times)
(a)ClO_3 (b) ClO (c) Cl_2O_5 (d)Cl_2O_7

19.Which one is perchloric acid:
(a) $HClO$ (b) $HClO_3$ (c) $HClO_2$ (d) $HClO_4$

Topic No: 5.5.5: Bleaching Powder:

20. Bleaching powder may be produced, by passing chlorine over: (2 times)
(a) Calcium carbonate (b) Hydrated calcium sulphate
(c) Anhydrous calcium sulphate (d) Calcium hydroxide

21- Hydrogen bonding is strongest among the molecule:
(a) HCl (b)HBr (c) HI (d) HF

22- Which one is the strongest acid: **(5 times)**
(a) HClO (b) $HClO_2$ (c) $HClO_3$ (d) $HClO_4$

2019

23. Weakest acidic solution wil be of:
(a) HF (b) HBr (c) HI (d) HCl

24. An element that has a high ionization energy and tends to be chemically inactive, would most likely to be:
(a) An alkali metal (b) A transition element (c) A noble gas (d) A halogen

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
C	B	B	C	B	C	B	A	A	D	C	D	B	D
15	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**				
B	B	A	D	D	D	D	D	A	C				

SHORT QUESTIONS OF CHAPTER-5 HALOGENS AND THE NOBLE GASES ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 5.1: Introduction:

1 Arrange the following ions in order of increasing size F^-, Cl^-, Br^-, I^- **(2 times)**
Ans: $F^- < Cl^- < Br^- < I^-$

2 Why iodine has metallic luster? **(6 times)**
Ans: Due to big size of iodine outer electrons are excited by taking light and due to excitation and de-excitation gives metallic luster.

3 Why the lattice energy of Fluorides is greater than Chlorides? **(2 times)**
Ans: Due to small size of fluoride ions (F^-), there will be a better overlap of orbitals and consequently leads to shorter and stronger bonds with other elements. Ionic fluorides have higher lattice energies than the chlorides and the value is responsible for the insolubility of the fluorides in water. Due to low dissociation energy of fluorine molecule, it is highly reactive. The other halogens react slowly under similar conditions. The fluorides are, however more stable with respect to dissociation into elements.

4 Give reason that fluorine is gas, iodine is solid.
Ans: Iodine molecule has larger size than fluorine. The intermolecular attraction (London Forces)is greater in the larger molecules having greater masses. Due to the larger size of iodine molecule the van der Waal's forces are stronger than smaller size molecules of fluorine.

5. Which Halogen sublimes to violet vapours.
Ans: Iodine sublimes to violet vapours.

6. How does fluorine differs from other halogens?
Ans: Fluorine differs from other halogens because.
(i) F atom has small size Ionic flourides have high lattice energies than other halides.
(ii) Fluorine is only halogen which directly reacts with nobel gases like *Kr*, *Xe*, *Rn* forming their fluorides.

Topic No: 5.4: Oxidizing Properties:

7 Compare halogen acids in their reducing properties?
Ans: HF, HCl, HBr and HI act as reducing agents in the following order:
HF < HCl < HBr < HI

8 Why Flourine acts as a strong oxidizing agent?
Ans: Oxidizing power of fluorine is higher, because it has low energy of dissociation and higher hydration energy of its ions. Due to the relative strength as oxidizing agents, It is possible for each free halogen to oxidize the ions of other halogens next to it in the family. Fluorine can oxidize all the halide ions to molecular halogens.

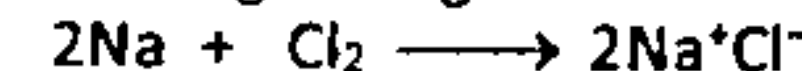
9 Halogens are strong oxidizing agents. Justify. **(4 times)**
Ans: All the free halogens act as oxidizing agents when they react with metals or nonmetals. On forming ionic compounds with metals, the halogen s gain electrons and are converted to negative halide ions.

$$2Na + Cl_2 \longrightarrow 2Na^+Cl^-$$

The oxidizing power of halogens decreases with increase in atomic number.

10. On what factors oxidizing power of halogens depends upon? **(3 times)**
Ans:
(i). Energy of dissociation.
(ii). Electron affinity of atoms.
(iii). Hydration energies of ions.
(iv). Heat of vapourization (Br_2 and I_2)

11. Why oxidizing power of F_2 is higher than other halogens?
Ans: Oxidizing power of F_2 is higher, because it has low energy of dissociation and higher hydration energy of its ions. Due to the relative strength as oxidizing agent it is possible for each free halogen to oxidize the ions of other halogens next to it in the family.

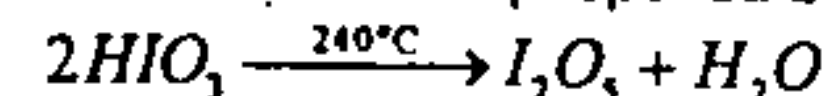
12 Why oxidizing power of halogens decreases down the group? **(2 times)**
Ans: Oxidizing power of halogens depends upon the following factors:
(i). Energy of dissociation.
(ii). Electron affinity of atoms.
(iii). Hydration energies of ions.
(iv). Heat of vapourization (Br_2 and I_2)
While going down the group, all above mentioned factors decreases. All the free halogens act as oxidizing agents when they react with metals or nonmetals. On forming ionic compounds with metals, the halogen s gain electrons and are converted to negative halide ions. $2Na + Cl_2 \longrightarrow 2Na^+Cl^-$
The oxidizing power of halogens decreases with increase in atomic number.

Topic No: 5.5.1: Hydrides:

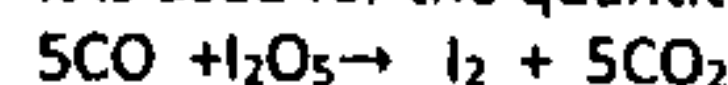
13 HF is a weak acid while HCl is strong acid .Give reason. **(10 times)**
Ans: The strength hydrogen halogen bond is very high in HF. The bond strength is reflected in the case of dissociation of hydrogen and halides. Hydrofluoric acid is a week acid due to limited ionization than hydrochloric acid.

14 Write four properties of hydrogen fluoride?
Ans:
(i). HF is a colourless volatile liquid.
(ii). HF attacks glass and has found application as non-aqueous solvent.
(iii). HF has melting point as -83.8 °C.
(iv). HF has boiling point as 19.5 °C.

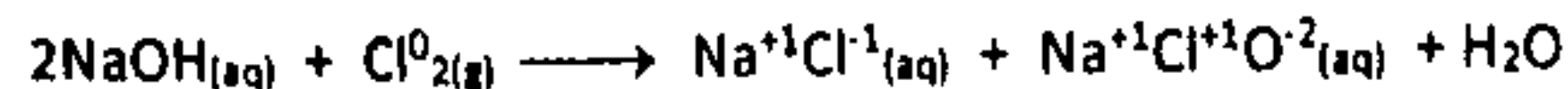
Topic No: 5.5.2: Oxides of Halogens:

15 Give one method of preparation and one use of I_2O_5?
Ans: **Preparation:** It can be prepared by heating iodic acid at 240ºC

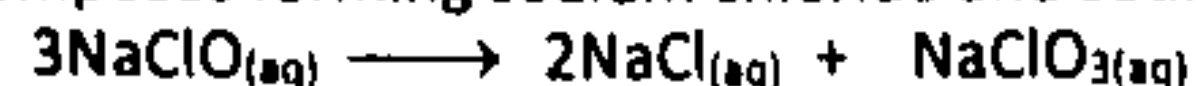
$$2HIO_3 \xrightarrow{240^\circ C} I_2O_5 + H_2O$$

Use: It is used for the quantitative analysis of CO.

$$5CO + I_2O_5 \rightarrow I_2 + 5CO_2$$

Topic No: 5.5.3: Reactions of Chlorine with Cold and Hot NaOH:

16 Write down reaction of chlorine with cold & hot NaOH? **(5 times)**
Ans: **(i).** Chlorine will react with cold aq. NaOH at 15°C to form hypochlorite and a halide.

$$2NaOH_{(aq)} + Cl^0_{2(g)} \longrightarrow Na^{+1}Cl^{-1}_{(aq)} + Na^{+1}Cl^{+1}O^{-2}_{(aq)} + H_2O$$

The reaction is disproportionation reaction, because the zero oxidation sate of chlorine atom in Cl_2 is converted to -1 in chloride and +1 in hypochlorite.

(ii). Sodium hypochlorite which is produced in cold state in the above reaction, decomposes forming sodium chloride and sodium chlorate at 70 °C.

$$3NaClO_{(aq)} \longrightarrow 2NaCl_{(aq)} + NaClO_{3(aq)}$$

The reaction is again disproportionation reaction.

Topic No: 5.5.4: Oxyacids:

17 Arrange following oxyacids in increasing order of acid strength and oxidizing power ; $HClO_4 > HClO_2 > HClO$ (2 times)

Ans: $HClO_4 > HClO_2 > HClO$

18 Give the names and formulae of oxyacids of chlorine?

Ans:

Name	Formulae
Hypochlorous acid	$HClO$
Chlorous acid	$HClO_2$
Chloric acid	$HClO_3$
Perchloric acid	$HClO_4$

19 HXO_4 is strongest oxyacid.Explain (2 times)

Ans: The acidic strength increases with the increase in the number of oxygen atoms. As the oxidation state of the halogen increases, the bonding electrons are shifted away from the H-atom and the tendency of the molecule to lose a proton increases. This accounts for the change of strength of oxyacids. HXO_4 has four oxygen atoms, so it is strongest oxyacid.

20 Describe factor of acidic strength of oxyacids of halogens?

Ans:
(i). Number of oxygen atoms attached to the oxyacid of halogens.
(ii). Oxidation state of hydrogen in oxyacid of halogens.
(iii). Tendency to lose proton from oxyacid of halogens.
(iv). The acidic strength increases in the order.

$$HClO < HClO_2 < HClO_3 < HClO_4$$

21 Write formulas of two Oxides of Bromine.

Ans:

	Name	Formula
1.	Bromine monoxide	Br_2O
2.	Bromine dioxide	BrO_2
3.	Bromine trioxide	BrO_3 (Br_3O_6)

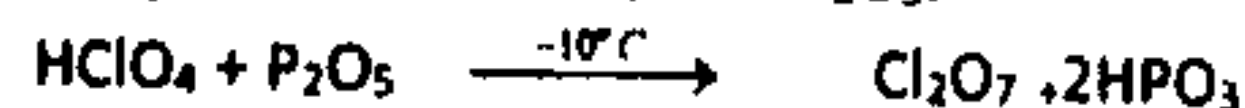
22 Perchloric acid is considered as valuable analytical reagent. Why?

Ans: Due to oxidizing effect of perchloric acid it is considered as valuable analytical reagent.

23 Justify that Cl_2O_7 is the anhydride of perchloric acid? (2 times)

Ans: <u>Cl_2O_7 is an anhydride:</u>

Cl_2O_7 is ,the anhydride of perchloricacid, it can be obtained at -10°C by dehydration of $HClO_4$ with P_2O_5.

$$HClO_4 + P_2O_5 \xrightarrow{-10°C} Cl_2O_7 + 2HPO_3$$

Topic No: 5.5.5: Bleaching Powder:

24 How bleaching powder is prepared by Hasenclever,s method? (2 times)

Ans: The apparatus used in this method consist of 4 to 8 iron cylinders placed one above the other horizontally. They are interconnected and provided with stirrers. The slaked lime is added in through a hopper in the upper cylinder and is transported from one cylinder to the other with rotating stirrers. Chlorine introduced into the lowest cylinder rises up and reacts with slaked lime to form bleaching powder, which is collected through the outlet in the lower cylinder.

25 Write four uses of bleaching powder? (3.times)

Ans: Bleaching powder is used:

(i). for the laboratory preparation of chlorine and oxygen. It is also used in the manufacture of chloroform.

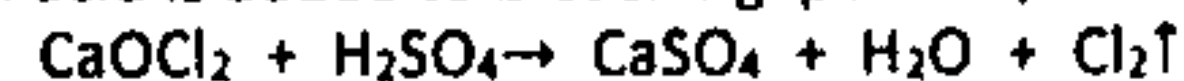
(ii). as a disinfectant and in the sterilization of water.
(iii). for making unshrinkable wool.
(iv). for bleaching cotton, linen and paper pulp. (delicate fabrics like wool, silk etc. can not be bleached with it as these could be damaged by chlorine)

26 What is bleaching powder?

Ans: <u>Bleaching powder:</u> It is chemically $CaOCl_2$. Bleaching powder is a yellowish white powder with strong smell of chlorine, and is used to bleach different things. It has free chlorine known as "available chlorine", which is a main component of bleaching powder as bleaching agent.

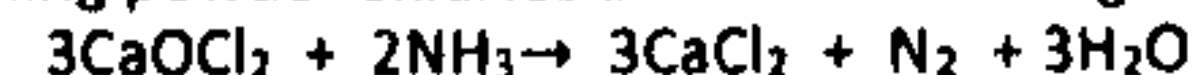
27 What is meant by available chlorine? (2 times)

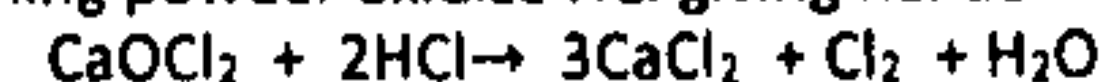
Ans: If excess of an acid is added to bleaching powder, chlorine is given out.

$$CaOCl_2 + H_2SO_4 \rightarrow CaSO_4 + H_2O + Cl_2\uparrow$$

The amount of chlorine thus set free is called available chlorine. The activity of bleaching powder is measured in terms of available chlorine. The average percentage of available chlorine in bleaching powder is 35-40 percent.

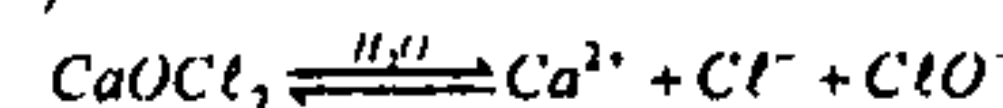
28 Write Chemical reactions of Bleaching Powder ($CaOCl_2$) with HCl and NH_3. (4 times)

Ans: (i). Bleaching powder oxidizes ammonia to nitrogen:

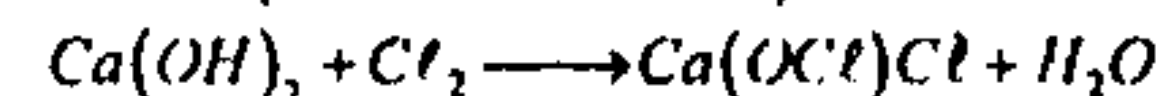
$$3CaOCl_2 + 2NH_3 \rightarrow 3CaCl_2 + N_2 + 3H_2O$$

(ii) Bleaching powder oxidize HCl giving halide

$$CaOCl_2 + 2HCl \rightarrow 3CaCl_2 + Cl_2 + H_2O$$

29. The bleaching action of bleaching powder is due to its oxidative character. Justify it.

Ans: Bleaching powder is an oxidizing agent. This property is due to generation of hypochlorite ion (OCl^-) in water.

$$CaOCl_2 \xrightleftharpoons{H_2O} Ca^{2+} + Cl^- + ClO^-$$

It can oxidizes and bleaches cotton, linen and paper pulp.

30. Name any two methods for manufacture of Bleaching powder. Also give reaction for this.

Ans: (a) Hesenclever's method (old method)
(b) Beckmann's method (Modern methods)

$$Ca(OH)_2 + Cl_2 \longrightarrow Ca(OCl)Cl + H_2O$$

LONG QUESTIONS OF CHAPTER-5 HALOGENS AND THE NOBLE GASES ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 5.4

1. Discuss Relative Reactivities of the Halogens as Oxidizing Agent.

Ans: (Text Book Page No:81)

Topic No: 5.5.4

2. Give rules for nomenclature of oxyacids of halogens.

Ans: (Text Book Page No:84)

Topic No: 5.5.5

3. What is Bleaching Powder? How is it prepared commercially?

Ans: (Text Book Page No:88)

4. How bleaching powder is prepared? Give its uses.

Ans: (Text Book Page No:88)

5. How does bleaching powder reacts with(i) NH_3 (ii) HCl (iii) H_2O (iv) dil H_2SO_4?

Ans: (Text Book Page No:89)

6. Write down reactions of $CaOCl_2$ with (i) CO_2 (ii) HCl (iii) NH_3 (iv) H_2SO_4

Ans: (Text Book Page No:89)

7. How bleaching powder is prepared by Hasenclever'smethod? Give its reaction with HCl and NH_3.

Ans: (Text Book Page No:88)

8. What happened when bleaching powder reacts with :
(a) dil. H_2SO_4 (b) conc. H_2SO_4 (c) NH_3 (d) HI

Ans: (Text Book Page No:89)

OBJECTIVES (MCQ'S) OF CHAPTER-6 TRANSITION ELEMENTS ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 6.1: Introduction:

1. Which is transition element?
(a) Ba (b) Na (c) Ra (d) Co

Topic No: 6.1.1: Typical and Non Typical Transition Elements:

2.GroupVIB of transition element contains: (5 times)
(a) Zn, Cd, Hg (b) Cr, Mo, W (c) Mg, Co, V (d) Zn, Fe, W

3.Typical transition element is: (11 times)
(a)Sc (b) Co (c)Ra (d) Y

4- Total number of d-block elements(transition metals) are: (2 times)
(a) 10 (b) 20 (c) 30 (d) 40

Topic No: 6.2.1: General Characteristics:

5. One of the following properties of transition elements does not vary with a regular pattern. Indicate that:
(a)Binding energy (b)Melting point (c)Covalent radius (d) All of them

6.The colour of transition metal complexes is due to: (7 times)
(a)d-d transitions of electrons (b) Paramagnetic nature of transition elements
(c) Ionization (d)Loss of s-electrons

7.The strength of binding energy of transition elements depends upon: (5 times)
(a)Number of electron pairs (b) Number of unpaired electrons
(c)Number of neutrons (d)Number of protons

8.Which of the following has greatest number of unpaired electrons? (3 times)
(a) Fe (b) Fe^{+2} (c) Mn^{+2} (d) Cr^{+3}

9.Which one shows paramagnetic behaviour?
(a)Fe^{3+} (b) Zn^{2+} (c)Cd^{2+} (d)Sc^{3+}

10- Which element form an ion with charge +3: (4 times)
(a) Chromium (b) Copper (c) Lead (d) Zinc

11.Which of the following is a non-typical transition element? (8 times)
(a)Cr (b) Mn (c)Zn (d)Fe

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12. Maximum number of unpaired electrons are in cation:
(a) Ni^{2+} (b) CO^{2+} (c) Mn^{2+} (d) Fe^{2+}

13. Which one is non – typical transition element:
(a) Cr (b) Mn (c) Zn (d) Fe

14. The total number of transition elements is:
(a) 10 (b) 14 (c) 40 (d) 58

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
D	B	B	C	D	A	B	C	A	A	C	C	C	D

SHORT QUESTIONS OF CHAPTER-6 TRANSITION ELEMENTS ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 6.2.1: General Characteristics:

1 Give four important characteristics of Transition Elements? (3 times)

Ans: (i). Melting and boiling points: Transition metals have very high melting and boiling points due to strong binding forces present between their atoms.
(ii). Binding Energy:Transition metals are tough, malleable and ductile. The toughness of these metals indicate strong metallic binding. This is because, apart from s electrons of the outer most shell, the electrons of underlying half-filled d-orbitals also participate in binding.
(iii). Oxidation state:Transition metals exhibit variable valency or oxidation state. They show variable valencies because of the involvement of the unpaired d-electrons to s-electrons in bond formation.
(vi). Colour In transition elements, the d-orbitals are responsible for the colour development in their compounds. When these orbitals are involved in bonding, they split up into two energy levels, one set has a higher energy than the other. The electrons residing in low energy d-orbitals absorb a part of the visible light and jump to high energy d-orbitals. This process is called d-d transition.

2 What is the cause of paramagnetic behaviour?

Ans: Paramagnetic behaviour is caused by the presence of unpaired electrons in an atom, molecule or ion because there is a magnetic moment associated with the spinning electron. It increases with the increase in the number of unpaired electrons.

3. What are Paramagnetic and Diamagnetic substances? (2 times)

Ans: Substances which are weakly attracted by a strong magnetic field are called paramagnetic substances.
Those substances which are weakly repelled by a strong magnetic field are called diamagnetic substances.

4 What are interstitial compounds? (4 times)

Ans: Interstitial compounds:-When small non-metal atoms like H,B, C and N enter the interstices of transition metals and impart useful features to them, they are called Interstitial compounds. These are non-stoichiometric compounds. Sometimes they are also termed as interstitial alloys.

5 What type of elements form substitution alloy and why? (2 times)

Ans: Owing to the similarty in the sizes of transition metals, some transition metal atoms are able to replace one another in the metallic lattice and form substitutional alloys among themselves. Alloy steels are important example of this type of material in which iron atoms are substituted by chromium, manganese and nickel atoms etc. to give the steel more useful properties. Other examples are brass, coinage alloys etc.

6. Why Transition metals show variable valencies (oxidation states)? (5 times)

Ans: Transition metals exhibit variable valencies or oxidation states. They show variable valencies because of the involvement of the unpaired d electrons to s electrons in bond formation.

7 Give reason for the development of colours in the transition complexes? (5 times)

Ans: In transition elements, the d-orbitals are responsible for the colour development in their compounds. When these orbitals are involved in bonding, they split up into two energy levels, one set has a higher energy than the other. The electrons residing in low energy d-orbitals absorb a part of the visible light and jump to high energy d-orbitals. This process is called d-d transition.

8 Explain d-d transition?

Ans: **d-d transition:-** When d orbitals are involved in bonding, they split up into two energy levels, one set has a higher energy than the other. The electrons residing in low energy d orbitals absorb a part of the visible light and jump to high energy d orbitals. This process is called d-d transition.

9 What is d-d transition explain it with respect to $[Ti(H_2O)_6]^{3+}$

Ans: **d-d transition:-** When d orbitals are involved in bonding, they split up into two energy levels, one set has a higher energy than the other. The electrons residing in low energy d-orbitals absorb a part of the visible light and jump to high energy d-orbitals. This process is called d-d transition.

Explanation: In $[Ti(H_2O)_6]^{3+}$, yellow light is absorbed, while most of the blue and red lights are transmitted, therefore the solution of $[Ti(H_2O)_6]^{3+}$ ions looks violet in colour.

10 Define substitutional alloy? Give an example.

Ans: **Substitutional alloy:** Due to the similarity in the sizes of transition metals, some transition metal atoms are able to replace one another in the metallic lattice and form substitutional alloys among themselves. Alloy of steels are an important example of this type of material in which iron atoms are substituted by chromium, manganese and nickel atoms, etc. to gi steel more useful properties.

11. Define paramagnetism? Which two transition ns have strongest paramagnetic behaviour.

Ans: **Paramagnetism:**
The substances which are weakly attracted by a st etic field are called paramagnetic substances and phenomenon is cal amagnetism . For example Fe^{3+} and Mn^{2+}.

12. Give reason that M.P and B.P show maximum value of the middle of 1st transition series.

Ans: M.P and B.P show maximum value of the middle of 1st transition series and then decrease to a minimum level at the end of the series. This trend in M.P correlates well with the strength of binding force.

13. Why transition metals exhibit variable valency.

Ans: They show variable valency because of involvement of unpaired d – electrons in addition to s – electrons in bond formation.
This increases no. of valencies for transition metals.

Topic No: 6.5.1: Corrosion:

14 Define corrosion?

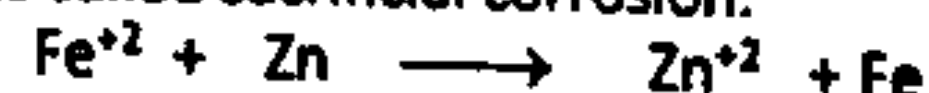
Ans: **Corrosion:-** Any process of chemical decay of metal is due to the action of surrounding medium is called corrosion.

15 What is Tin plating & what happens when it is damaged? (3 times)

Ans: **Tin plating:** The process of tin plating consists of dipping the clean sheet of iron in a bath of molten tin and then passing it through hot pair of rollers.

Damaged tin plating: If the protective coating is damaged, then iron comes into contact with moisture. A galvanic cell is established in which tin acts as a cathode and iron as an anode. The electrons flow from iron to tin, where they discharge H^+ ions, leaving behind OH^- in the solution. These hydroxide ions react with iron forming $Fe(OH)_3$ which dissolves rapidly in water. From this, it can be concluded that plated iron gets rust more rapidly when the protective coating is damaged than the non-plated iron.

16. Define sacrificial corrosion. (3 times)

Ans: **Sacrificial corrosion:** If a protective layer of zinc is damaged a galvanic cell is established in the presence of moisture. Iron serves as a cathode and zinc as an anode. Electrons flow from zinc to iron, as a result of which Zn decays while Fe remains intact. This is called sacrificial corrosion.

$$Fe^{+2} + Zn \longrightarrow Zn^{+2} + Fe$$

LONG QUESTIONS OF CHAPTER-6 TRANSITION ELEMENTS ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 6.2.1

1 Define paramagnetism and discuss behaviour in transition element.

Ans: (Text Book Page No:101)

2 Mn^{2+} and Fe^{2+} have the strongest paramagnetic behaviour while Sc^{3+} and Zn^{2+} have the lowest. Discuss. (2 times)

Ans: (Text Book Page No:101)

3. Explain the following properties of transition metals. (2 times)
(i) Paramagnetism (ii) Colour

Ans: (Text Book Page No:101+102)

4. Explain the following properties of transition metals.
(i) Colour (ii) Chelate formation

Ans: (Text Book Page No:102+104)

Topic No: 6.3.3

5 Write systematic name of the following complexes:
(i) $[Co(NH_3)_6]$ (ii) $Na_3[COF_6]$ (iii) $[pt(OH)_2(NH_3)_4]SO_4$ (iv) $K_2[ptCl^6]$

Ans: (Text Book Page No:105)

6 Give Systematic names to following complexes:
(i) $[Pt(OH)_2(NH_3)_4]SO_4$ (ii) $[Cr(OH)_3(H_2O)_3]$
(iii) $K_2[Cu(CN)_4]$ (iv) $[Fe(H_2O)_6]^{2+}$

Ans: (Text Book Page No:105)

Topic No: 6.5

7 What is corrosion? Explain the electrochemical theory of corrosion. (3 times)

Ans: (Text Book Page No:109+110)

Topic No: 6.5.1

8 Discuss Electrochemical theory of Corrosion.

Ans: (Text Book Page No:110)

9. Define corrosion. Explain electrochemical theory of Corrosion in detail.

Ans: (Text Book Page No:109+110)

Topic No: 6.5.2

10 Distinguished between cathode coating and anode coating of iron.

Ans: (Text Book Page No:111)

OBJECTIVES (MCQ'S) OF CHAPTER-7 FUNDAMENTAL PRINCIPLES OF ORGANIC CHEMISTRY ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic Nos: 7.1: Introduction:

1. Vital force theory was rejected by:
(a) G.N.Lewis (b) Friedrick Wohler
(c) Scientist of 20th century (d) Greek Philosophers

2. The chemist synthesized urea from ammonium cyanate was: (2 times)
(a) Berselius (b) Koble (c) Wholer (d) Lavoiscr

3. -SH functional group is called:
(a) Cyano (b) Mecrapto (c) Nitro (d) Carboxyl

Topic No: 7.6: Reforming:

4. The process used to improve quality of gasoline is called:
(a) Thermal cracking (b) Reforming (c) Steam cracking (d) Combustion

Topic No: 7.9: Hybridization:

5. In which of the following compound carbon atom is sp^2-hybridized:
(a) CH_3CN (b) $CH_2=CH_2$ (c) C_2H_2 (d) CH_2Cl_2

6. A double bond consists of: **(6 times)**
(a) One sigma and one pi bonds (b) Two sigma bonds
(c) One sigma and two pi bonds (d) Two pi bonds

7. The state of hybridization of carbon in methane is : **(5 times)**
(a) Sp^3 (b) Sp^2 (c) Sp (d) dsp^2

8. Presence of double or triple bond is sign of: **(3 times)**
(a) Unsaturation (b) Saturation (c) Addition (d) Substitution

9. Linear shape is associated with which set of Hybrid orbital: **(7 times)**
(a) sp (b) sp^2 (c) sp^3 (d) dsp^2

10. The hybridization of carbon atom in HCHO is:
(a) Sp (b) Sp^2 (c) Sp^3 (d) dsp

11-One of the following Molecule is sp^2 hybridized:
(a) CH_3-CH_3 (b) $CH_2=CH_2$ (c) $CH \equiv CH$ (d) CH_4

12- Which set represent the planner triangular shape: **(7 times)**
(a) Sp^3 (b) Sp^2 (c) Sp (d) dSp^2

13- Each carbon atoms is sp^3 – hybridized in the class of:
(a) Alkenes (b) Alkynes (c) Ketones) Alkanes

14- The state of hybridization in ethane molecule is: **times)**
(a) dsp^2 (b) sp^3 (c) sp^2 sp

15- The carbon atom of carboxyl group is hybridized:
(a) Sp (b) Sp^2 (c) Sp^3 dsp^2

16. The bond angle between any two Sp^2-Hybridized orbit
(a) 120° (b) 180° (c) 109.5° 107.5°

17. The state of hybridization of carbon in ethane is:
(a) Sp^3 (b) Sp^2 (c) Sp (d) dSp^2

Topic No: 7.10: Isomerism:

18. Pentane (C_5H_{12}) shows how many chain isomers? **(2 times)**
(a) 2 (b) 3 (c) 4 (d) 5

19. Dimethyl ether may show which types of isomerism: **(2 times)**
(a) Tautomerism (b) Metamerism (c) Geometric (d) Functional group

20. Tautomerism arises due to shifting of :
(a) Sigma electrons (b) Neutrons (c) Pi-Electrons (d) Protons

21- Which class of organic compounds shows metamerism:
(a) Aldehydes (b) Ethers (c) Alkenes (d) Alkanes

22. The isomerism shown by alkanes is:
(a) Skeletal (b) Position (c) Geometric (d) Metamerism

23. Ethers show the phenomenon of: **(6 times)**
(a) Position isomerism (b) Functional group isomerism
(c) Metamerism (d) Cis-trans isomerism

24. Select from the following the one which is an alcohol:
(a) CH_3-CH_2-OH (b) CH_3-O-CH_3 (c) CH_3COOH (d) C_2H_5-Br

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25. Both CH_3COOH and $HCOOCH_3$ show isomerism:
(a) position (b) chain (c) geometric (d) functional group

26. In t-butyl alcohol, the tertiary carbon is bonded to:
(a) Two hydrogen atoms (b) Three hydrogen atoms (c) One hydrogen atom (d) No hydrogen atom

27. Tetra Ethyl Lead (T.E.L.) is used as:
(a) Pain Killer (b) Petroleum Additive (c) Fire Extinguisher (d) Moth Repellent

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
B	C	B	B	B	A	A	A	A	B	B	B	D	B	B
16	17	18	19	20	21	22	23	24	25	26	27			
A	A	B	D	D	B	A	C	A	D	D	B			

SCHORT QUESTIONS OF CHAPTER-7
FUNDAMENTAL PRINCIPLES OF ORGANIC CHEMISTRY
ACCORDING TO ALP SMART SYLLABUS-2020-21

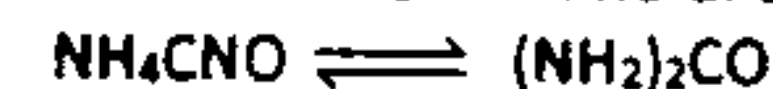
Topic No: 7.1: Introduction:

1 What is vital force theory? **(5 times)**

Ans: Early scientists believe that organic compounds could be manufactured only by and within living things under action of a super natural force called vital force and these compounds could never be synthesized from inorganic materials, this theory was referred to as vital force theory.

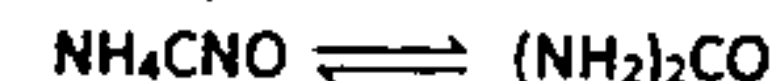
2 Why vital force theory was rejected.

Ans: **Rejection of vital force theory:** Vitalfoce theory was rejectedby Friedrick Wohler when he synthesized urea $(NH_2)_2CO$, an organic compound from ammonium cyanate, NH_4CNO, a substance of known mineral origin.

$$NH_4CNO \rightleftharpoons (NH_2)_2CO$$

Since the synthesis of urea from ammonium cyanate, million of organic compounds have been prepared and analyzed.

3 Name organic compound first of all prepared in the laboratory, and how?

Ans: Friedrick Wohler synthesized urea $(NH_2)_2CO$, an organic compound from ammonium cyanate, NH_4CNO, a substance of known mineral origin.

$$NH_4CNO \rightleftharpoons (NH_2)_2CO$$

4. Define Organic chemistry what is vital force theory.

Ans: **Organic Chemistry:**

Branch of chemistry which deals with study of compounds of carbon and hydrogen (Hydrocarbons) and their derivatives.

Vital Force Theory:

"It was believed by early chemists that organic compounds could be made by living things under action of super natural force, called vital force". This theory was called vital force theory.

Topic No: 7.2: Some Features of Organic Compounds:

5 Write down any two characteristics features of organic compounds?

Ans: **1..Non Ionic Character of Organic Compounds:** Organic compounds are generally covalent compounds, therefore, do not give ionic reactions.

2..Isomerism: Isomerism is a very common phenomenon in organic compounds. Very often more than one compounds are represented by the same molecular formula. However, they have different structural formulas.

Topic No: 7.5: Cracking of Petroleum:

6. Define" Thermal cracking". **(3 times)**

Ans: **Thermal cracking:**-Breaking down of large molecules by heating at high temperature and pressure is called thermal cracking. It is particularly useful in the production of unsaturated hydrocarbons such as ethene and propene.

7. Discuss two methods of cracking of petroleum?

Ans: **1.. Thermal cracking:**- Breaking down of large molecules by heating at high temperature and pressure is called thermal cracking. It is particularly useful in the production of unsaturated hydrocarbons such as ethene and propene.

2.. Catalytic cracking:- Higher hydrocarbons can be cracked at lower temperature (500 °C) and lower pressure (2 atm), in the presence of a suitable catalyst. A typical catalyst used for this purpose is a mixture of silica (SiO_2) and alumina (Al_2O_3). Catalytic cracking produces gasoline of higher octane number and therefore this method is used for obtaining better quality gasoline.

8. Define catenation? (5 times)

Ans: **Catenation:-** The property of carbon atoms to link with other carbon atoms to form long chains or rings is called catenation. The main reason of such large number of compounds is catenation of carbon atoms.

9. What is catalytic cracking? (4 times)

Ans: **Catalytic cracking:-**Higher hydrocarbons can be cracked at lower temperature (500°C) and lower pressure (2 atm), in the presence of a suitable catalyst. A typical catalyst used for this purpose is a mixture of silica (SiO_2) and alumina (Al_2O_3). Catalytic cracking produces gasoline of higher octane number and therefore, this method is used for obtaining better quality gasoline.

10. Write importance of cracking.

Ans: Besides increasing the yield fo gasoline, cracking has also produced large amount of useful by-products, such as ethane, propene, butane and benzene. These are used for manufacturing drugs, plastics, detergents, synthetic fibres, fertilizers, weed killers and important chemicals like ethanol, phenol and acetone.

11. Write down the useful by products of cracking process.

Ans: **By products of cracking process:**

Unsaturated hydrocarbons like ethene, propene, butene and benzene. These are used for making drugs, plastics, fibres, fertilizers and many other important chemicals.

Topic No: 7.6: Reforming:

12. Branched hydrocarbons are better as a fuel as compared to straight chain, explain?

Ans: Straight chain hydrocarbons have low octane numbers and make poor fuels. Experiments have shown that isooctane or 2,2,4- trimethyl pentane burns very smoothly in an engine and has been arbitrarily given an octane number of 100.

$$CH_3-(CH_2)_6-CH_3 \xrightarrow{Heat,\,catalyst} CH_3-\underset{CH_3}{\overset{CH_3}{C}}-CH_2-\underset{H}{\overset{CH_3}{C}}-CH_3$$

n-Octane 2,2,4- trimethyl pentane

13. Octane number of gasoline is improved by reforming. Explain(2 times)

Ans: The octane number of galosline is improved by a process called reforming. It involves the conversion of straight chain hydrocarbons into branched chain by heating in the absence of oxygen and in the presence of catalyst.

$$CH_3-(CH_2)_6-CH_3 \xrightarrow{Heat,\,catalyst} CH_3-\underset{CH_3}{\overset{CH_3}{C}}-CH_2-\underset{H}{\overset{CH_3}{C}}-CH_3$$

n-Octane 2,2,4- trimethyl pentane

14. Give idea about knocking in the internal combustion engine.

Ans: **Knocking in the internal combustion engine:**

The gasoline fraction present in petroleum in generally not of good quality. When it burns in an automobile engine, combustion can be initiated before the spark plug fires. This produces a sharp metallic sound called knocking which greatly reduces the efficiency of an engine.

Topic No: 7.7: Classification of Orgnanic Compounds:

15. What are Alicyclic compound? Write one example.

Ans: The compounds in which the ring consists of only carbon atoms is called carbocyclic compounds. For example:

Cyclopropane (CH_2 ring of three: CH_2, CH_2—CH_2) cyclobutane (CH_2—CH_2 / CH_2—CH_2)

16. Differentiate between alicyclic & aromatic compuounds? (6 times)

Ans: **Alicyclic compounds:**The homocyclic compounds which contains a ring of three or more carbon atoms and resembling aliphatic compounds are called alicyclic compounds. The saturated alicyclic hydrocarbons have the general formula C_nH_{2n}.

For example: Cyclopropane (CH_2 ring of three: CH_2, CH_2—CH_2) cyclobutane (CH_2—CH_2 / CH_2—CH_2)

Aromaticcompounds: The carbocyclic compounds containing at least one benzene ring, six carbon atoms with three alternate double and single bonds are called aromatic compounds. These bonds are usually shown in the form of a circle. For example benzene

(benzene structure with H atoms) or (hexagon with alternate double bonds) or (hexagon with circle)

17. Write the structural formulae for Neopentane and Isobutylene?

Ans: **Structural formulae for Neopentane and Isobutylene:-**

Structural formula for Neopentane: $CH_3-\underset{CH_3}{\overset{CH_3}{C}}-CH_3$

Structural formula for Isobutylene: $CH_3-\overset{CH_3}{C}=CH_2$

18. Classify open chain compounds with examples.

Ans: Open chain may be branched or non branched. Open chain hydrocarbons are also called aliphatic compounds.

(a). Straight chain compounds: Those organic compounds in which the carbon atoms are connected in series from one to the other. For example:

$CH_3-CH_2-CH_2-CH_3$ n-Butane $CH_2=CH-CH_2-CH_3$ 1-Butene

(b). Branched chain compounds: Those organic compounds in which the carbon atoms are attached on the side of the chain. For example:

$CH_3-\overset{CH_3}{CH}-CH_3$ 2-Methylpropane(Iso-Butane) $CH_3-\overset{CH_3}{C}=CH_2$ 2-Methylpropene

19. Give names of four compounds which are homocyclic but are not aromatic?

Ans: 1. Cyclopropane 2. Cyclobutane 3. Cyclo pentane 4. Cyclohexane

20. What are Alicyclic Compounds? Give an example. (5 times)

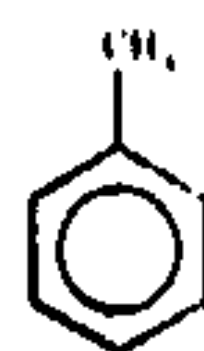
Ans: **Alicyclic compounds:**The homocyclic compounds which contains a ring of three or more carbon atoms and resembling aliphatic compounds are called alicyclic compounds. The saturated alicyclic hydrocarbons have the general formula C_nH_{2n}.

For example:

Cyclopropane cyclobutane

21. Give formulas of cyclopropane and toluene.

Ans: Formulas of cyclopropaneand toluene:

Formula of cyclopropane : CH_2–CH_2–CH_2 (ring) Formula of toluene : $C_6H_5CH_3$

22. Name the formulae of two compounds" (a) Aniline (b)Phenanthrene

Ans:

Name	Molecular Formula	Structural Formula
Aniline	$C_6H_5NH_2$	
Phenanthrene	$C_{14}H_{10}$	

23. Write name and structure of two aromatic heterocyclic compounds?(3 times)

Ans:

No:	Name	Structure
1..	Pyridine	
2..	Furan	

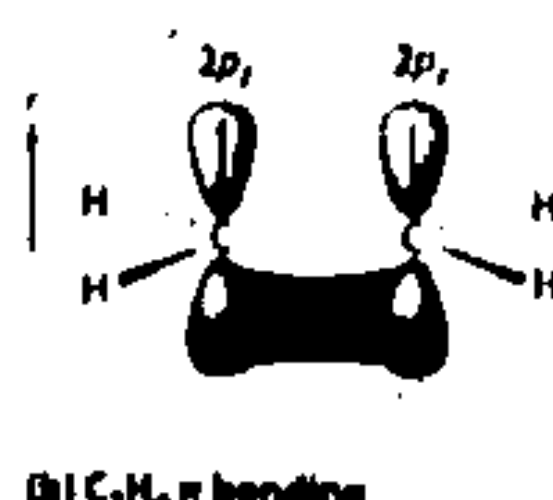
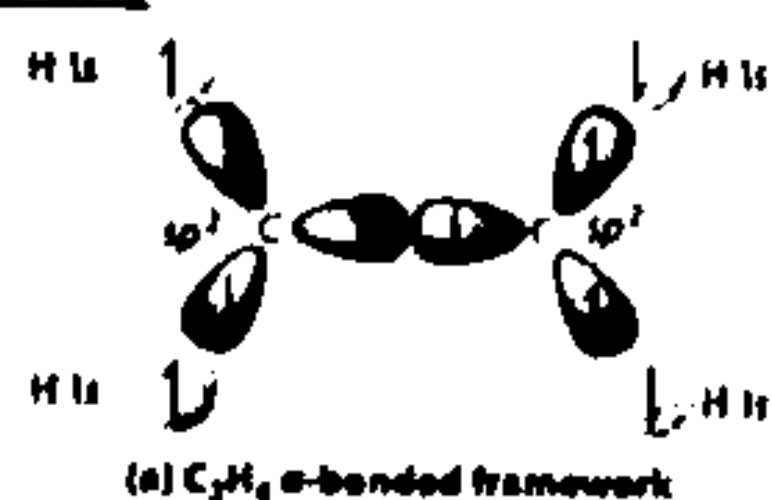
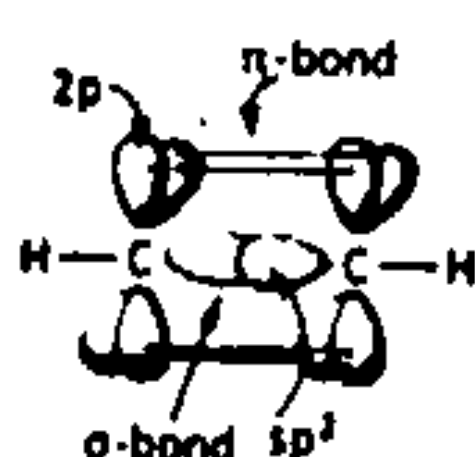
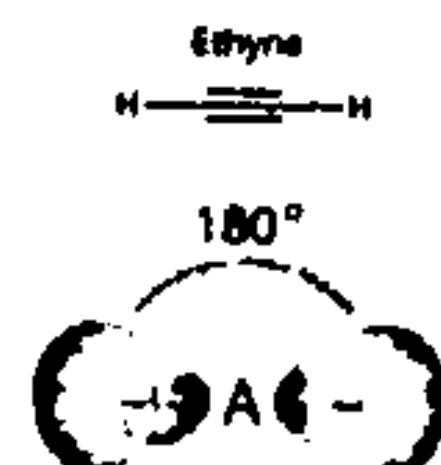
Topic No: 7.9: Hybridization:

24. Give shapes and angles of following compounds using hybridization approach:
(a)$CH_2=CH_2$ (b)$HC\equiv CH$

Ans: (a). $CH_2=CH_2$

(a) C_2H_4 σ-bonded framework (b) C_2H_4 π bonding

(b). $HC\equiv CH$

Ethyne 180° π-bond σ-bond sp^2

25 In alkanes sp^3 hybridization occurs. Discuss?

Ans: sp^3 hybridization:- In Alkanes each carbon as four partially filled sp^3 hybrid orbitals. Each C – H bond is formed by sp^3 – 1s overlap and each C–C bond by sp^3–sp^3 overlap. The bond angle is 109.5° and geometry is tetrahedral.

26 Write types of bonds and shapes of HCHO and CH_3Cl using hybridization approach?

Ans:

		Types of bonds	Shapes
1..	HCHO	sp^2 hybridized O ‖ H-C-H	Trianguler planner
2..	CH_3Cl	sp^3 hybridized H H - C-Cl H	Tetrahedral

27 When does sp-hybridization occur?

Ans: sp-hybridization:-When one 2s and one 2p orbitals of the carbon atom mix together to give rise to two degenerated sp hybridized atomic orbitals. These orbitals have linear shape with a bond angle of 180ºC.

28. What is Atomic Orbital Hybridization?

Ans: Mixing up of atomic orbitals to form newly generated orbitals of same energy and same shape is called atomic orbital hybridization.

For example: in carbon electron from the 2s orbital is promoted to an empty $2p_z$ orbital giving electron configuration:

29 When does sp^3-Hybradization occur?

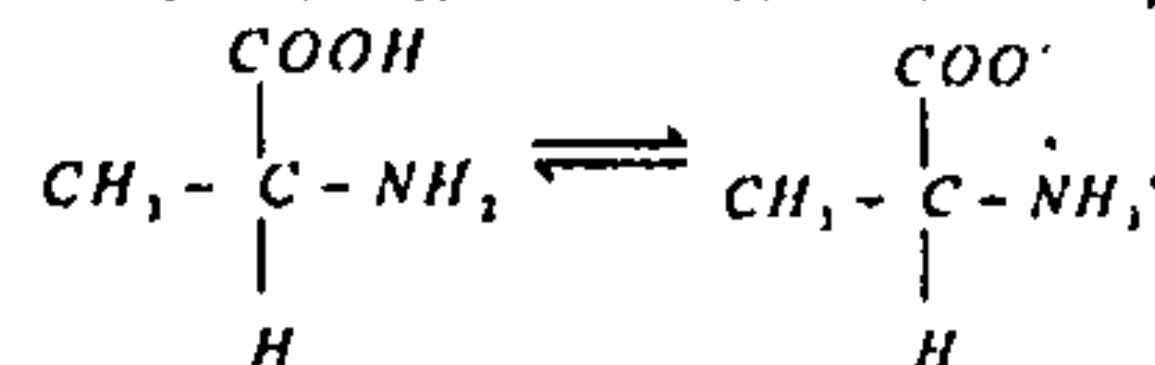
Ans: sp^3-Hybradization:- When one s and three p orbitals mix together to form four new equivalent hybrid atomic orbitals, having same shape and energy. This mode of hybridization is called tetrahedral or sp^3 hybridization. All these four sp3 hybrid orbitals are degenerated (having equal energy) and are directed at an angle of 109.5º in space to give a tetrahedral geometry.

For example, in the formation of alkane, the four hybrid atomic orbitals of carbon overlap separately with four atomic orbitals to form four equivalent bonds.

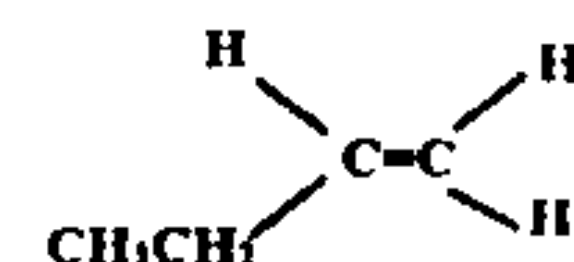
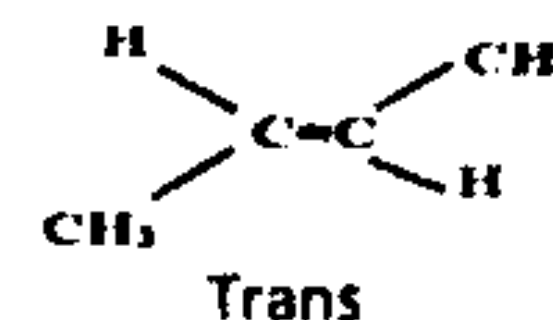
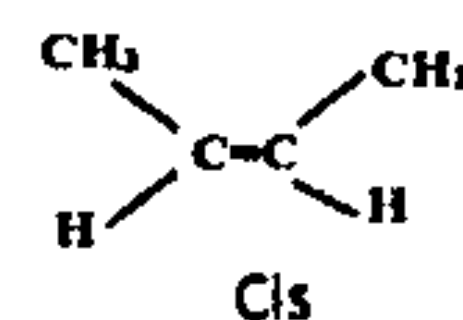
Topic No: 7.10.1: Isomerism:

30 Define tautumerism, give an example? (6 times)

Ans: Tautumerism:-This type of Isomerism arises due to shifting of proton from one atom to other in the same molecule. For example:

$$CH_3-\underset{H}{\overset{COOH}{C}}-NH_2 \rightleftharpoons CH_3-\underset{H}{\overset{COO^-}{C}}-NH_3^+$$

31. 1-Butyne does not show geometrical isomerism but 2-Butene does. Give reason? (3 times)

Ans: The necessary and sufficient condition for a compound to exhibit geometric isomerism is that the two groups attached to the same carbon must be different. In 1-Butene similar hydrogen atoms are attached to the same carbon atom, so it does not exhibit geometric isomerism.

$(H)(CH_3CH_2)C=C(H)(H)$

But 2-Butene can exist in the form of cis and trans isomers as:

32 Write a brief note on geometric isomerism?

Ans: **Definition:** Such compounds which possess the same structural formula, but differ with respect to the positions of the identical groups in space are called geometric isomers, and the phenomenon is known as the geometric isomerism.

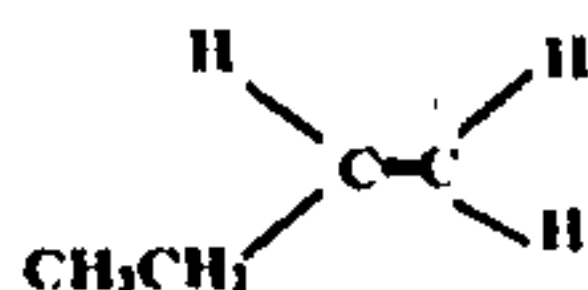
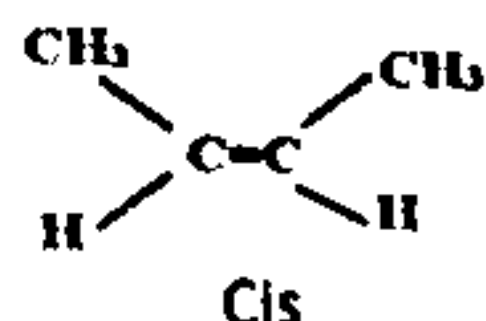
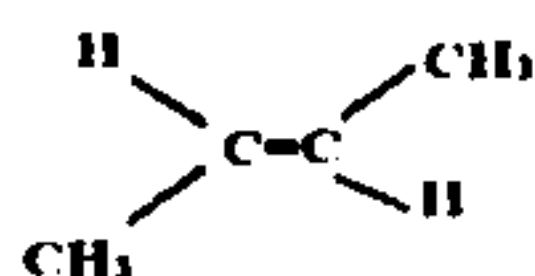
Explanation: Two carbon atoms joined by a single bond are capable of free rotation about it. However, when two carbon atoms are joined by a double bond, they cannot rotate freely. As a result, the relative positions of the various groups attached to these carbon atoms get fixed and give rise to cis-trans isomers.

The necessary and sufficient condition for a compound to exhibit geometric isomerism is that the two groups attached to the same carbon must be different.

Examples: In 1-Butene similar hydrogen atoms are attached to the same carbon atom, so it does not exhibit geometric isomerism.

H, H / C=C / CH_3CH_2, H

But 2-Butene can exist in the form of cis and trans isomers and show geometric isomerism as:

CH_3, CH_3 / C=C / H, H — Cis

H, CH_3 / C=C / CH_3, H — Trans

33 **Give examples of positional isomerism in alkenes and alkynes?**

Ans: **Examples of alkenes:**-CH_3-CH_2-CH=CH_2 , CH_3-CH=CH-CH_3
1-Butene 2-Butene

Examples of alkynes:-CH_3-CH_2-C≡CH , CH_3-C≡C-CH_3
1-Butyne 2-Butyne

34 **Why is restricted rotation necessary to show the geometrical isomerism?** **(3 times)**

Ans: **Restricted rotation:-** Two carbon atoms joined by a single bond are capable of free rotation about it. However, when two carbon atoms are joined by a double bond, they cannot rotate freely. As a result, the relative positions of the various groups attached to these carbon atoms get fixed and give rise to cis-trans isomers.

35 **Explain position isomerism with an example?** **(2 times)**

Ans: **Position isomerism:-** The isomerism arises due to the difference in the position of the same functional group on the carbon chain, the arrangement of carbon atoms remains the same.

Examples of alkenes:-CH_3-CH_2-CH=CH_2 , CH_3-CH=CH-CH_3
1-Butene 2-Butene

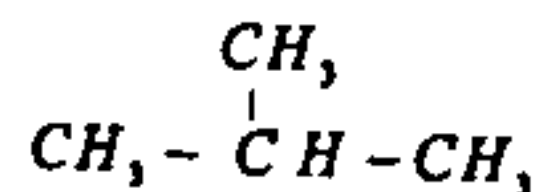
Examples of alkynes:-CH_3-CH_2-C≡CH , CH_3-C≡C-CH_3
1-Butyne 2-Butyne

36 **What is metamerism? Give an example.** **(9 times)**

Ans: Isomerism arises due to the unequal distribution of carbon atoms on either side of the functional group. Such compounds belong to the same homologous series for example diethyl ether and methyl n-propyl ether are metamers.

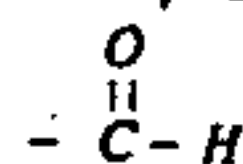
CH_3-CH_2-O-CH_2-CH_3 — Diethyl ether
CH_3-O-CH_2-CH_2-CH_3 — Methyl n-propyl ether

37 **Write two possible isomers of C_4H_{10}. Write their IUPAC names also?**

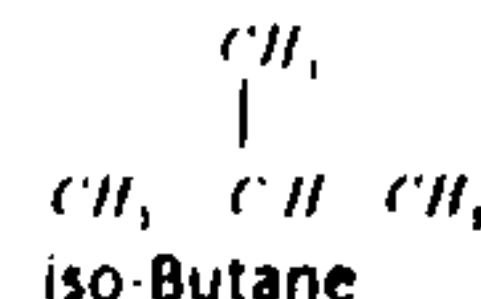
Ans: 1.. $CH_3-CH_2-CH_2-CH_3$ 2.. $CH_3-\overset{CH_3}{\overset{|}{C}}H-CH_3$

IUPAC Names: n-Butane, 2 Methylpropane

38 **Define functional group isomerism and give an example?** **(3 times)**

Ans: **Definition:** An atom or a group of atoms or a double bond or a triple bond whose presence imparts specific properties to organic compounds is called a functional group, because they are the chemitally functional parts of molecules.

Example: Formyl Group $-\overset{O}{\overset{||}{C}}-H$

39 **Cis-trans isomerism is a result of restricted rotation of carbon –carbon double bond. Discuss?**

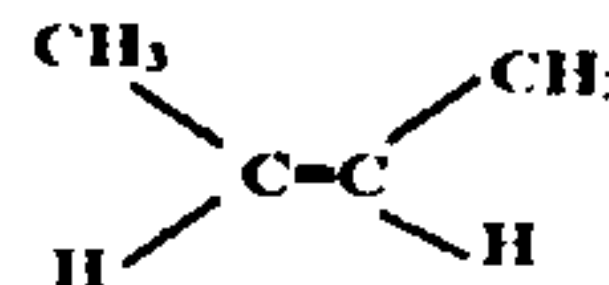
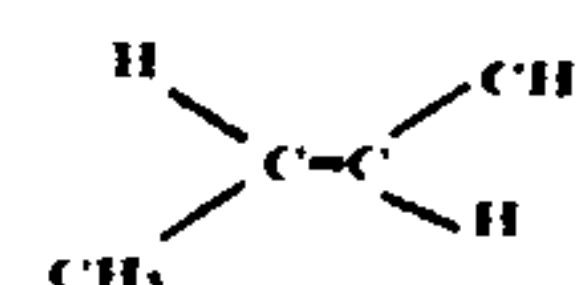
Ans: Two carbon atoms joined by a single bond are capable of free rotation about it. However, when two carbon atoms are joined by a double bond, they cannot rotate freely. As a result, the relative positions of the various groups attached to these carbon atoms get fixed and give rise to cis-trans isomers.

40 **Draw all isomers of C_4H_{10}?**

Ans: 1.. $CH_3\ CH_2\ CH_2-CH_3$ — n-Butane 2.. $CH_3\ \overset{CH_3}{\overset{|}{C}}H\ CH_3$ — iso-Butane

41. **What are the conditions for cis and Trans isomerism?**

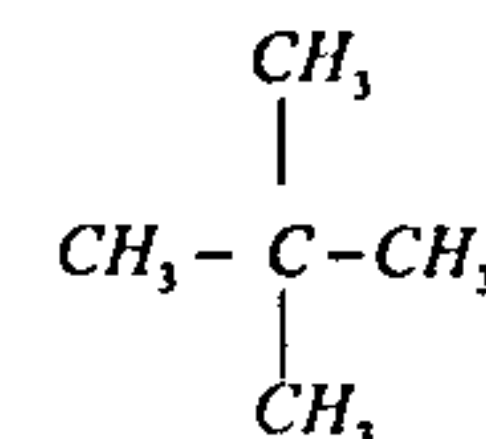
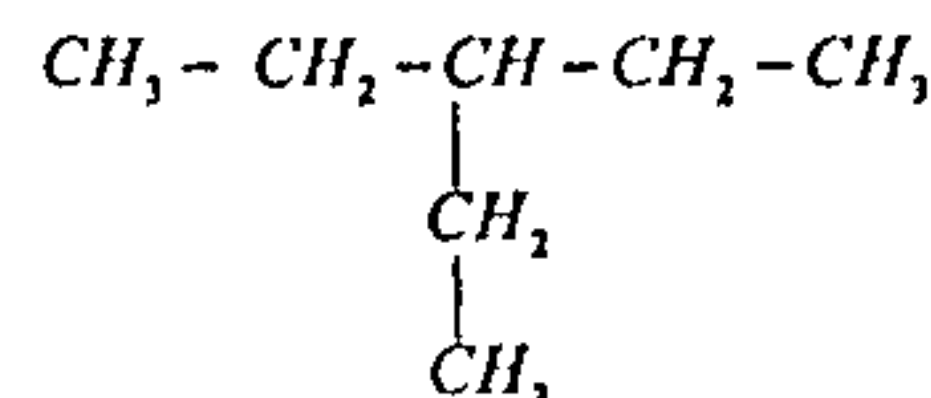
Ans: The necessary and sufficient condition for a compound to exhibit geometric isomerism (Cis-Trans Isomerism) is that the two groups attached to the same carbon must be different.

For example: 2-Butene can exist in the form of cis and trans isomers and show geometric isomerism as:

CH_3, CH_3 / C=C / H, H — Cis

H, CH_3 / C=C / CH_3, H — Trans

42. **Write structural formula of neopentane and 3-Ethylpentane.**

Ans:

$CH_3-\overset{CH_3}{\overset{|}{C}}-CH_3$ with CH_3 below C — Neopentane

$CH_3-CH_2-\underset{\underset{CH_3}{|}}{\underset{CH_2}{|}}{CH}-CH_2-CH_3$ — 3-Ethylpentane

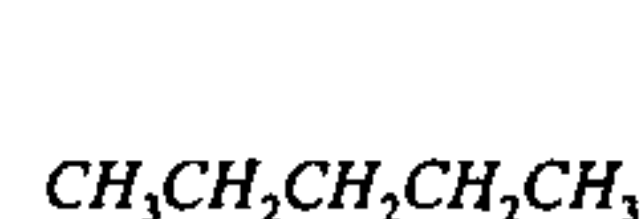
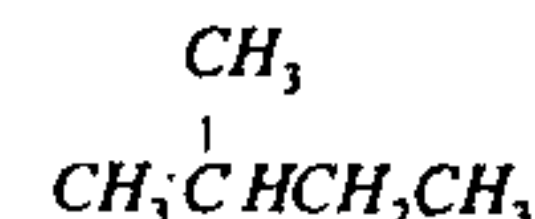
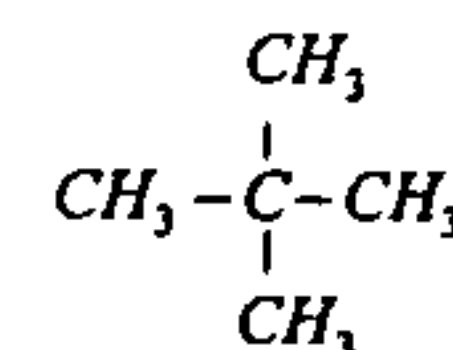
43. **What are isomers. Write isomers of pentane.**

Ans: Isomers:

Compounds having same molecular formula but different structural formula are called isomers.

e.g; Isomers of Pentane

$CH_3CH_2CH_2CH_2CH_3$ — *n – pentane*

$CH_3\overset{CH_3}{\overset{|}{C}}HCH_2CH_3$ — *Iso – pentane*

$CH_3-\overset{CH_3}{\overset{|}{C}}-CH_3$ with CH_3 below C — *Neo – pentane*

LONG QUESTIONS OF CHAPTER-7 FUNDAMENTAL PRINCIPLES OF ORGANIC CHEMISTRY ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 7.1

1. **What is an organic compound? Give importance of Wholer's work in development of organic chemistry.**

Ans: (Text Book Page No:118)

2. **Why vital force theory was rejected? What is the importance of Wohler's work it chemistry?**

Ans: (Text Book Page No:118)

Topic No: 7.5

3. **Define cracking and discuss its different types.** **(7 times)**

Ans: (Text Book Page No:122)

4. **Define cracking of petroleum. Explain its various types and importance.** (6 times)
Ans: (Text Book Page No:122)

Topic No: 7.6

5. **Explain reforming of petroleum with the help of suitable example.** (7 times)
Ans: (Text Book Page No:123)
6. **What is meant by reforming of petroleum? Explain knocking and octan number in that regards.** (2 times)
Ans: (Text Book Page No:123)

Topic No: 7.7

7. **How organic compounds are classified? Give suitable examples of each type.** (3 times)
Ans: (Text Book Page No:123)
8. **Differentiate between homocyclic and heterocyclic compounds with two examples each.** (2 times)
Ans: (Text Book Page No:124)
9. **Define alicyclic compounds and aromatic compounds with one example in each case.**
Ans: (Text Book Page No:124+125)

Topic No: 7.8

10. **Define functional group. Give names and formulas of oxygen containing functional groups.** (2 times)
Ans: (Text Book Page No:126)

Topic No: 7.9

11. **Define Sp^3 and Sp^2 hybridization, give one example in each case.**
Ans: (Text Book Page No:127+128)
12. **What is orbital hybridization? Explain Sp^3 mode of hybridization of carbon.** (4 times)
Ans: (Text Book Page No:127)
13. **What is Sp hybridization? Explain structure of acetylene according to this theory.** (3 times)
Ans: (Text Book Page No:129)
14. **Define hybridization and also describe sp-hybridization with reference to ethyne.** (4 times)
Ans: (Text Book Page No:129)
15. **Define atomic orbital hybridization and describe structure of Ethene in the view of atomic orbital hybridization.** (3 times)
Ans: (Text Book Page No:128)
16. **Explain Sp^2 hybridization along with describing the structure of Etheneon the basis of this type of hybridization.** (7 times)
Ans: (Text Book Page No:128)
17. **Explain Sp^3 hybridization. How it explain the structure of methane.**
Ans: (Text Book Page No:127)
18. **Describe Structure of C_2H_4 and C_2H_2 by process of hybridization.**
Ans: (Text Book Page No:127)

Topic No: 7.10.1

19. **Define any four types of isomerism with one example each.** (3 times)
Ans: (Text Book Page No:130+131)
20. **Discuss geometric isomerism with atleast two examples.** (4 times)
Ans: (Text Book Page No:132)
21. **Draw the structural formulae of four possible isomers of C_6H_{14}.**
Ans: (Text Book Page No:131)
22. **Describe briefly the different types of structural isomerism.** (9 times)
Ans: (Text Book Page No:130+131)

23. **Explain isomerism and its various types with examples.** (4 times)
Ans: (Text Book Page No:130)
24. **Define isomerism. Discuss (i) Geometrical isomerism (ii)Position isomerism**
Ans: (Text Book Page No:131)

OBJECTIVES (MCQ'S) OF CHAPTER-8
ALIPHATIC HYDROCARBON
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 8.3: Nomenclature:

1- Formula of Marsh gas is:
(a) CH_4 (b) C_2H_6 (c) C_3H_8 (d) C_4H_{10}

Topic No: 8.3.4: Reactions of Alkanes:

2. Which types of reactions are given by alkanes?
(a) Polymerization (b) Elimination (c) Substitution (d) Addition
3. Formula of Chloroform is: (6 times)
(a) CH_3Cl (b) CH_2Cl_2 (c) $CHCl_3$ (d) CCl_4
4. The catalytic oxidation of methane produces:
(a) $CO + H_2O$ (b) $CO_2 + H_2O$ (c) $C + H_2O$ (d) H_3C-OH
5- $CH_4 + Cl_2 \xrightarrow{h\nu}$ Product is:
(A) Chloroform only (B) Carbon tetra chloride only (C) $CH_3C\ell_2$ (D) Mixture of A, B, C

Topic No: 8.4.4: Alkenes:

6. Preparation of vegetable ghee involves: (2 times)
(a) Halogenation (b) Hydrogenation (c) Hydroxylation (d) Dehydrogenation
7. The addition of unsymmetrical reagent to an unsymmetrical alkene is in accordance with the rule:
(a) Hund's rule (b) Markownikow's rule (c) Pauli's Exclusive rule (d) Aufbau Principle
8. The presence of double bond in a compound is the sign of: (2 times)
(a) Saturation (b) Unsaturation (c) Substitution (d) None of these
9. Vegetable oils are:
(a) Polyesters (b) Glycerides of unsaturated fatty acids
(c) Essential oils (d) Fatty acid

Topic No: 8.4.5: Uses of Alkenes:

10. Mustard gas is obtained by the reaction of S_2Cl_2 with:
(a) Ethane (b) Ethene (c) Ethyne (d) Methane
11. Which is used for artificial ripening of fruits? (2 times)
(a) Ethane (b) Ethene (c) Acetylene (d) Propane
12. β, β – dichloro ethyl sluphide is commonly known as: (3 times)
(a) Mustard gas (b) Laughing gas (c) Bio-gas (d) Phosgene gas

Topic No: 8.5.4: Alkynes:

13. Synthetic rubber is made by polymerization of: (10 times)
(a) Chloroform (b) Acetylene (c) Divinyl acetylene (d) Chloroprene
14. Vinyl acetylene combine with hydrochloric acid to form: (14 times)
(a) Polyacetylene (b) Benzene (c) Chloroprene (d) Divinyl acetylene
15. Which compound has acidic hydrogen:
(a) butane (b) 1- butene (c) 1 – butyne (d) 2 – butyne

Topic No: 8.5.6: Comparison of Reactivities:

16- Which compound is most reactive: (2 times)
(a) Benzene (b) Ethane (c) Ethyne (d) Ethene
17- Which compound is the least reactive one?
(a) Benzene (b) Ethene (c) Ethane (d) Ethynes

2019

18. Conversion of unsaturated hydro carbons to saturated hydrocarbons in the presence of catalyst is called as:
(a) halogenation (b) hydrogenation (c) hydroxylation (d) dehydrogenation

19. Structural formula of vinyl chloride is:
(a) $HC \equiv C-Cl$ (b) $H_2C=CHCl$ (c) $H_3C-CHCl_2$ (d) H_2C-CH_2 with Cl, Cl

20. When 1-chloropropene is reacted with alcoholic KOH, the product obtained is:
(a) Propane (b) Propene (c) Propyne (d) Butane

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	C	C	D	D	B	B	B	B	B	B	A	D	C
15	16	17	18	19	20								
C	D	C	B	B	B								

SHORT QUESTIONS OF CHAPTER-8 ALIPHATIC HYDROCARBON ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 8.2.3: Nomenclature:

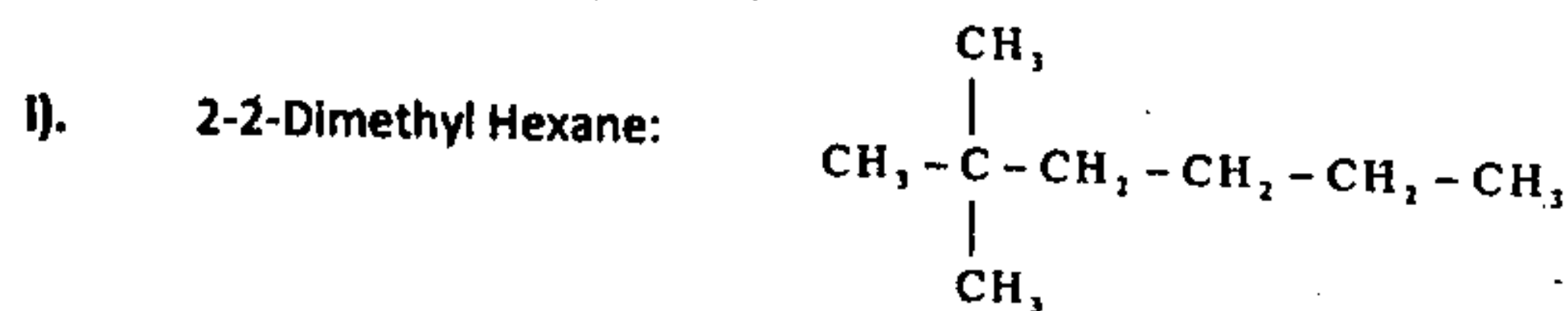
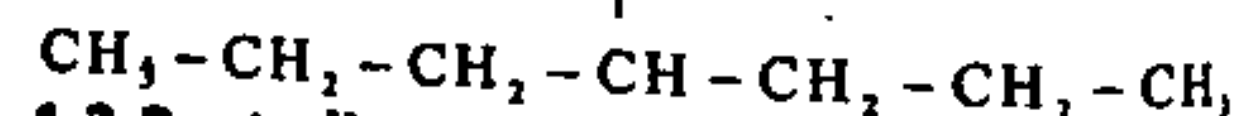
1 How common names of alkenes are derived? Give common names of $CH_2=CH_2$ and $CH_3-CH=CH_2$?

Ans: For alkanes, the word is derived from the Greek or Latin numerals indicating the number of carbon atoms in a molecule, and the name is completed by adding ane as a suffix. Alkenes are similarly named by replacing the ending – "ane" of the name of alkane with "ylene".
For example: $CH_2=CH_2$ has name Ethylene and $CH_3-CH=CH_2$ Propylene.

2 Write down the structural formula of the given compounds;
i). 2-2-Dimethyl Hexane ii). 4-iso-propyl heptane

Ans: Structural formula of compounds;

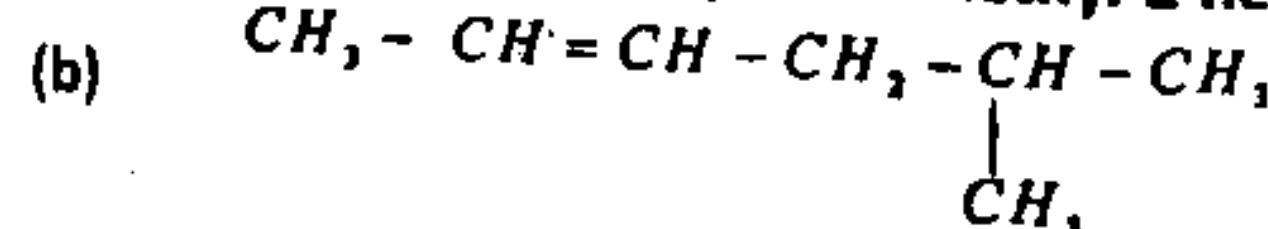
i). 2-2-Dimethyl Hexane: $CH_3-C(CH_3)_2-CH_2-CH_2-CH_2-CH_3$

ii). 4-iso-propyl heptane: $CH_3-CH_2-CH_2-CH(CH(CH_3)_2)-CH_2-CH_2-CH_3$ (branch: $CH_3-CH-CH_3$)

3 Write structural formulas of (i).. 1,3-Pentadiene (ii) Vinyl bromide

Ans: (i).. **1,3-Pentadiene** $CH_3-CH=CH-CH=CH_2$
(ii) **Vinyl bromide** $CH_2=CH-Br$

4 Draw structure of (a) 2-Methyl-2-butene (b) 5-Methyl-2-hexene

Ans (a) $CH_3-C(CH_3)=CH-CH_3$
2-Methyl-2-butene

(b) $CH_3-CH=CH-CH_2-CH(CH_3)-CH_3$
5-Methyl-2-hexene

5 Write structural formulas of the following: (2 times)
(a) but-1-en-3-yne (b) Vinyl acetylene.

Ans (a) $CH_2=CH-C\equiv CH$
but-1-en-3-yne

(b) $CH_2=CH-C\equiv CH$
Vinyl acetylene

6. Write names of the following compounds by IUPAC system.
(a) $(CH_3)_2CH=CH_2$ (b) $CH\equiv C-CH=CH-CH\equiv CH$

Ans: (a) $(CH_3)_2-CH=CH_2$ 2-methyl-1-propene
(b) $CH\equiv C-CH=CH-CH\equiv CH$ 3-hexene-1,5 diyne

7. Write down the structural formulas of
(a) 2 – Methyl propane (b) Neo pentane
(c) 3 – Ethyl pentane (d) 2, 2 – Dimethyl Pentane

Ans: (a) 2 – Methyl propane: $CH_3-CH(CH_3)-CH_3$

(b) Neo pentane: $CH_3-C(CH_3)_2-CH_3$

(c) 3 – ethyl pentane: $CH_3-CH_2-CH(CH_2CH_3)-CH_2CH_3$

(d) 2, 2 – dimethyl pentane: $CH_3-C(CH_3)_2CH_2CH_2CH_3$

8. Write structural formulas of followings.

(i) $2-n-propyl-1,4-pentadiene$

$CH_2=C(CH_2CH_2CH_3)-CH=CH-CH_3$

(ii) **Divinyl acetylene**

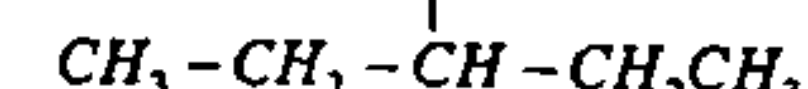
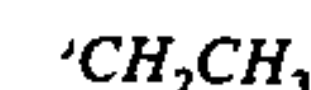
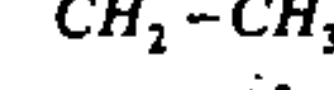
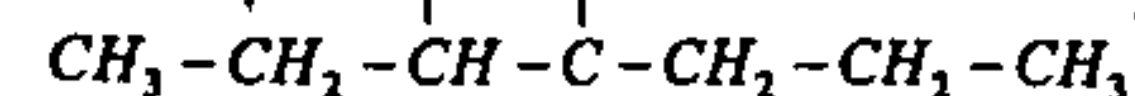
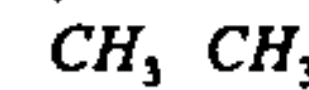
$CH_2=HC-C\equiv C-CH=CH_2$

9. Write down structural formulas of following compounds.
(a) 3 – Ethyl pentane (b) 4 – Ethyl – 3, 4 dimethyl Heptane

Ans: (a) 3 – Ethyl Pentane

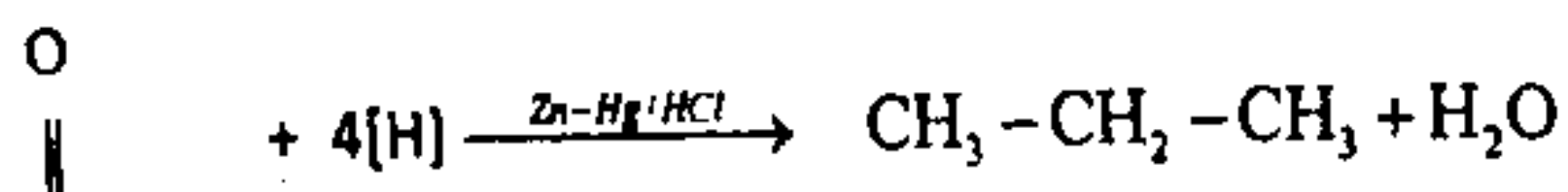
$CH_3-CH_2-CH(CH_2CH_3)-CH_2CH_3$

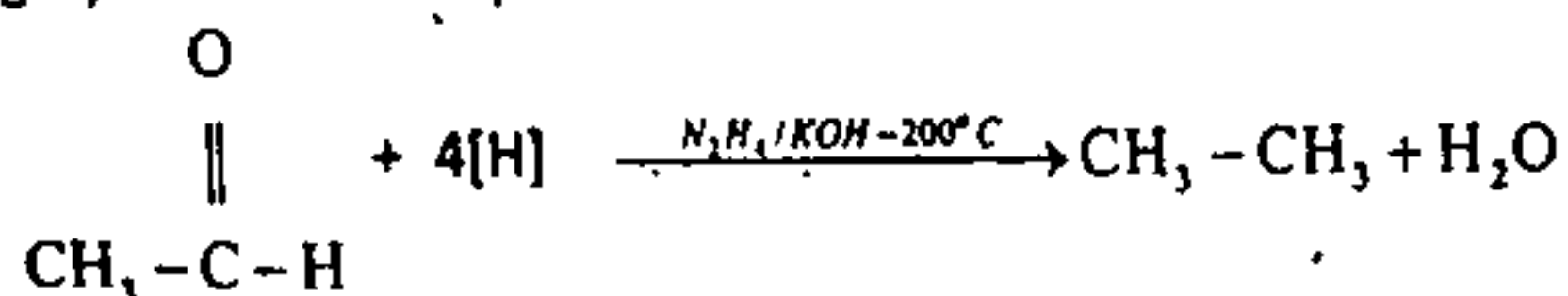
(b) 4 – Ethyl – 3, 4 – dimethyl heptane

$CH_3-CH_2-CH(CH_3)-C(CH_3)(CH_2-CH_3)-CH_2-CH_2-CH_3$

Topic No: 8.3.1: Preparation of Alkanes:

10 Prepare alkanes from Clemmensen and Wolf-Kishner's reduction methods from aldehyde or ketone? (5 times)

Ans: <u>Clemmensen reduction</u>: Alkanes can be prepared by reduction of ketone by using zinc mercury amalgam and hydrochloric acid.

$$CH_3-\overset{\overset{O}{\|}}{C}-CH_3 + 4[H] \xrightarrow{Zn-Hg/HCl} CH_3-CH_2-CH_3+H_2O$$

Wolf-Kishner's reduction: Alkanes can be prepared by reduction of aldehyde by using hydrazine in the presence of KOH.

$$CH_3-\overset{\overset{O}{\|}}{C}-H + 4[H] \xrightarrow{N_2H_4/KOH-200^\circ C} CH_3-CH_3+H_2O$$

11 How ethane can be prepared by Kolb's electrolysis? (3 times)

Ans: **Preparation of ethane by Kolb's electrolysis:-**

When a concentrated solution of sodium or potassium salt of a mono carboxylic acid is electrolyzed, an alkane is produced, this method is only suitable for the preparation of symmetrical alkanes.

$2RCOONa + 2H_2O \rightarrow R\text{-}R + 2CO_2 + 2NaOH + H_2$

During electrolysis following reactions occur at anode and cathode.

Topic No: 8.3.2: Physical Properties:

12 What is effect of branching on boiling points of alkanes? (2 times)

Ans: The boiling points of alkanes having branced chain structures are lower than their isomeric normal chain alkanes, e.g. n-butane has a higher boiling point (-0.5 °C) than isobutene (-117 °C).

Topic No: 8.3.3: Reactivity of Alkanes:

13 The sigma bonds are inert in alkanes. Explain?

Ans: In a σ-bond the electrons are very tightly held between the nuclei which make it very stable bond. A lot of energy is required to break it.

The alkanes or paraffins (Latin: parum= little, affins = affinity) under ordinary condition are inert towards acids, alkalis, oxidizing and reducing agents.

14 Sigma bonds are inert in alkanes. Justify. (2 times)

Ans: In a σ – bond the electrons are very tightly held between the nuclei which makes it a very stable bond. A lot of energy is required to break it. Moreover, the electrons present in a sigma bond can neither attack on any electrophile nor a nucleophile can attack on them. Both these facts make alkanes less reactive.

15. How non-polarity of alkanes is related to their unreactivity?

Ans: In alkanes both C – H and C – C bond show non-polar character, the ionic reagents such as acids, alkalies, oxidizing agents etc. find no. reaction site in alkane molecule to which they could be attached.

16. Write structural formulas of following compounds.

(i) 3 – methyl – 1 – Pentene – 4 – yne

(ii) But – 1 – en – 3 – yne

Ans: (i) 3 – methyl – 1 – penten – 4 – yne

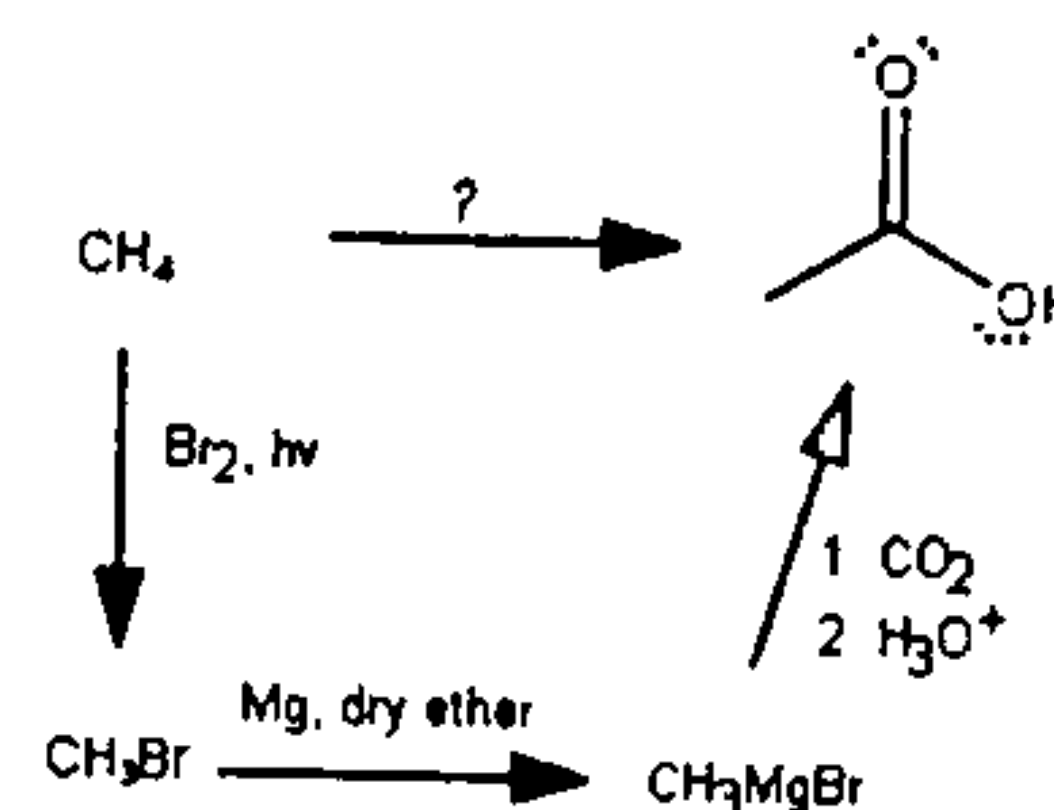
$$H_2C=CH-\underset{\underset{CH_3}{|}}{CH}-C\equiv CH$$

(ii) But – 1 – en – 3 – yne

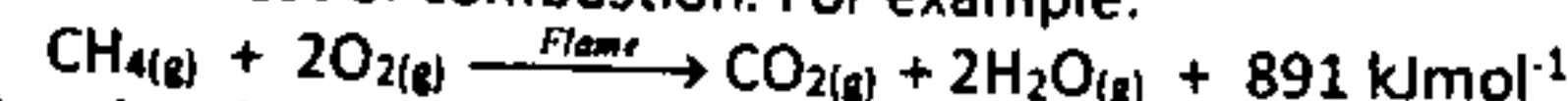
$$H_2C=CH-C\equiv CH$$

Topic No: 8.3.4: Reactions of Alkanes:

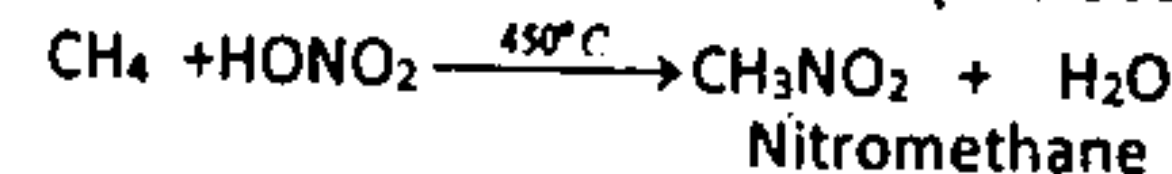
17. How will you convert methane into ethanoic acid?

Ans: **Conversion of methane:**

18 What is heat of combustion? (2 times)

Ans: **Heat of combustion:-** Burning of an alkane in presence of oxygen is known as combustion. Complete combustion of an alkene yields CO_2, H_2O and heat. The amount to heat evolved when one mole of a hydrocarbon is burnt to CO_2 and H_2O is called heat of combustion. For example:

$$CH_{4(g)} + 2O_{2(g)} \xrightarrow{Flame} CO_{2(g)} + 2H_2O_{(g)} + 891\ kJmol^{-1}$$

19 Describe nitration of methane.

Ans: **Nitration of methane:** It is substitution reaction of alkanes in which a hydrogen atom of an alkane is replaced by nitro group ($-NO_2$). Alkanes undergo vapour – phase nitration under drastic condition (400-500 °C) to give nitroalkanes e.g.

$$CH_4 + HONO_2 \xrightarrow{450^\circ C} \underset{\text{Nitromethane}}{CH_3NO_2} + H_2O$$

Nitroalkanes generally find use as fuel, solvents and in organic synthesis.

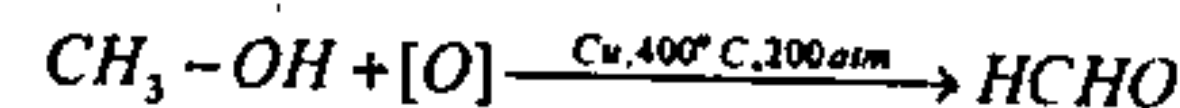
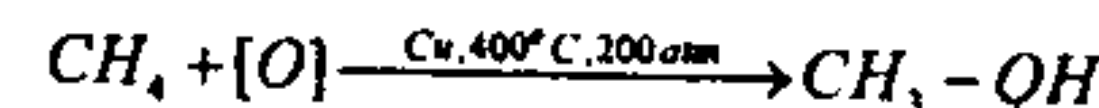
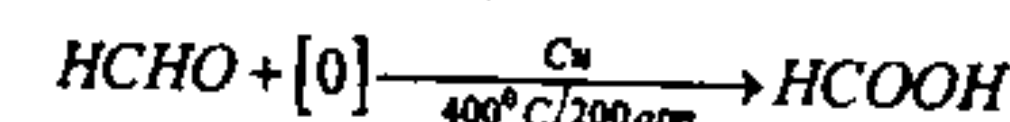
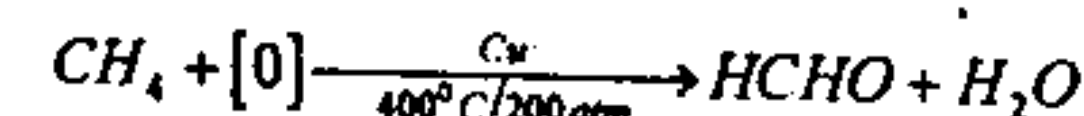
20. Convert CH_4 to CH_2O. (3 times)

Ans: 1. **Conversion of CH_4 to CH_2O:**

$$CH_4 + [O] \xrightarrow{Cu, 400^\circ C, 200 atm} CH_3-OH$$

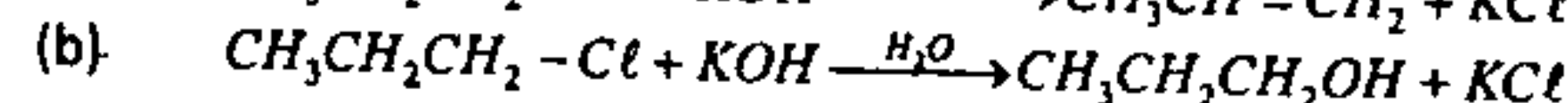
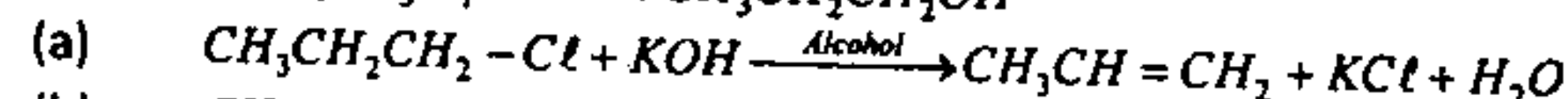
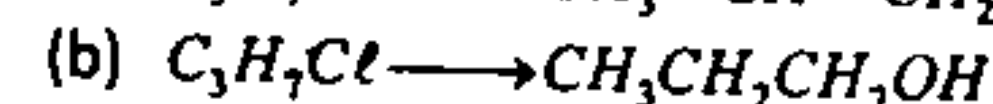
$$CH_3-OH + [O] \xrightarrow{Cu, 400^\circ C, 200 atm} HCHO$$

2. **Convert CH_4 to $HCOOH$**

$$CH_4 + [O] \xrightarrow[400^\circ C/200 atm]{Cu} HCHO + H_2O$$

$$HCHO + [O] \xrightarrow[400^\circ C/200 atm]{Cu} HCOOH$$

3. Convert (a) $C_3H_7Cl \longrightarrow CH_3-CH=CH_2$

(b) $C_3H_7Cl \longrightarrow CH_3CH_2CH_2OH$

(a) $CH_3CH_2CH_2-Cl + KOH \xrightarrow{Alcohol} CH_3CH=CH_2 + KCl + H_2O$

(b) $CH_3CH_2CH_2-Cl + KOH \xrightarrow{H_2O} CH_3CH_2CH_2OH + KCl$

Topic No: 8.3.5: Uses of Methane:

21 Give four uses of methane? (2 times)

Ans: Methane is used:

(i).. as a fuel and as an illuminating gas.

(ii).. for the preparation of methyl chloride, methylene chloride, chloroform and carbon tetrachloride.

(iii).. for the industrial preparation of methyl alcohol, formaldehyde and hydrogen cyanide.

(iv).. for the preparation of carbon black used in paints, prints, printing inks and automobiles tyres.

Topic No: 8.4: Alkenes:

22 Why are alkenes also called olefins?

Ans Alkenes also known as olefins(derived from Latin word olefiant meaning oil

forming) because its lower members form oily products on treatment with chlorine or bromine.

23 Write structural formulas of following: (1). Vinyl bromide (2)... Isobutylene. (2 times)

Ans: (1).. **Vinyl bromide:** $CH_2=CH-Br$

(2)... **Isobutylene.:** $CH_3-C(CH_3)=CH_2$

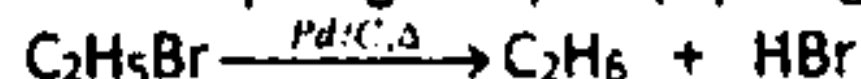
24 Why are some hydrocarbons called saturated and other unsaturated?

Ans: Those compounds in which the four valencies of carbon atoms are satisfied by single bonds to either other carbon atoms or hydrogen atoms are called saturated hydrocarbons. For example alkanes are saturated hydrocarbons.
Those compounds in which the four valencies of carbon atoms are not satisfied by single bonds, however, satisfied by double or triple bond are called un-saturated hydrocarbons. For example alkenes and alkynes are un-saturated hydrocarbons.

25 Convert methane to ethane? (2 times)

Ans: $CH_4 + Cl_2 \xrightarrow{Light, -HCl} CH_3Cl$
$CH_3Cl + Na + CH_3Cl \rightarrow CH_3-CH_3 + 2NaCl$

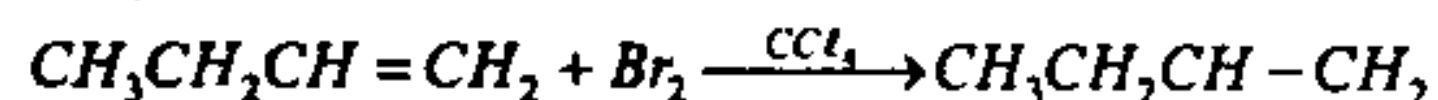
26. Starting from C_2H_5Br how will you prepare ethane and ethene.

Ans: **Ethane:** Alkanes also be prepared from alkyl halids using palladium charcoal as a catalyst. The method is known as Hydrogenolysis (hydrogenation accompanied by bond cleavage). $C_2H_5Br \xrightarrow{Pd/C,\Delta} C_2H_6 + HBr$

Ethene: Alkyl halides on heating with alcoholic potassium hydroxide undergo dehydrohalogenation i.e. elimination of a halogen atom together with a hydrogen atom from adjacent carbon atoms.

$$C_2H_5Br + KOH \xrightarrow{Alcohol} CH_2=CH_2 + KBr + H_2O$$

27. Write down structural formula of product formed when 1-butene reacts with Br_2 in $CC\ell_4$

Ans:

$$CH_3CH_2CH=CH_2 + Br_2 \xrightarrow{CCl_4} CH_3CH_2CH(Br)-CH_2(Br)$$

1-butene → 1,2-dibromobutane

Topic No: 8.4.3: Reactivity:

28 Why π-bond is more reactive than σ-bond?

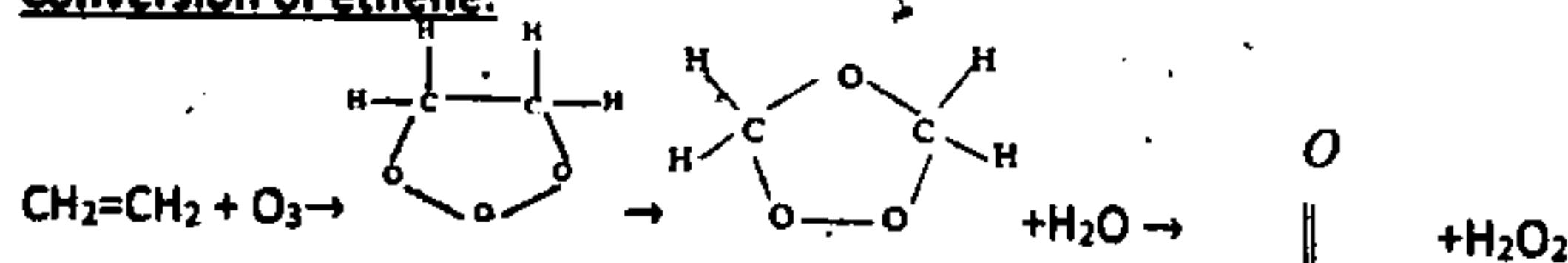
Ans: **π-bond is more reactive than σ-bond:-**
In the formation of a π-bond, the partially filled p-orbitals overlap in a parallel fashion, the probability of finding electron is thus away from the line joining the two nuclei, due to this reason π-electrons are less firmly held between the nuclei. A π-bond is, therefore, a weak bond as compared to a σ-bond. During the reaction it breaks comparatively easily rendering alkenes as reactive group of compounds.

Topic No: 8.4.4: Reactions of Alkenes:

29. How will you convert ethene into formaldehyde.

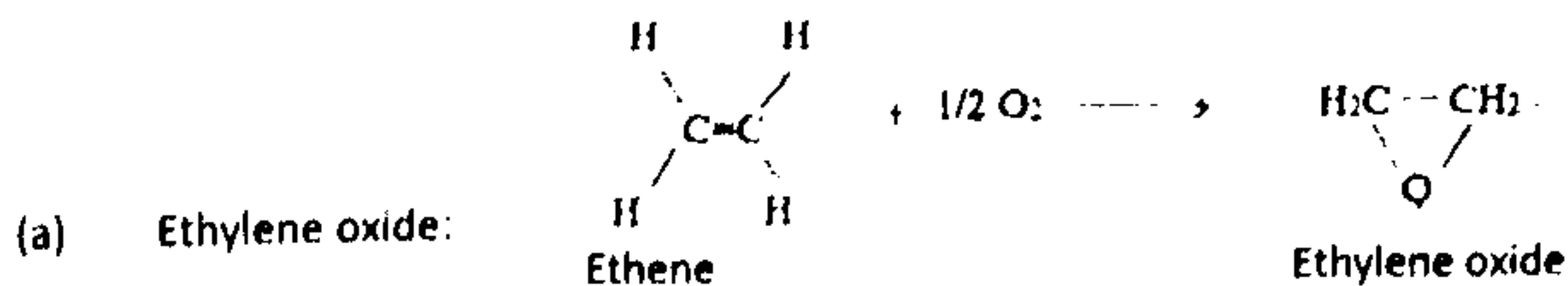
Ans: **Conversion of ethene:**

$CH_2=CH_2 + O_3 \rightarrow$ [Molozonide] $\rightarrow$ [Ozonide] $+ H_2O \rightarrow 2H-C(=O)-H + H_2O_2$

Ethen — Molozonide — Ozonide — Formaldehyde

30. How ethylene is converted into? (a) Ethylene oxide (b) Ethylene glycol

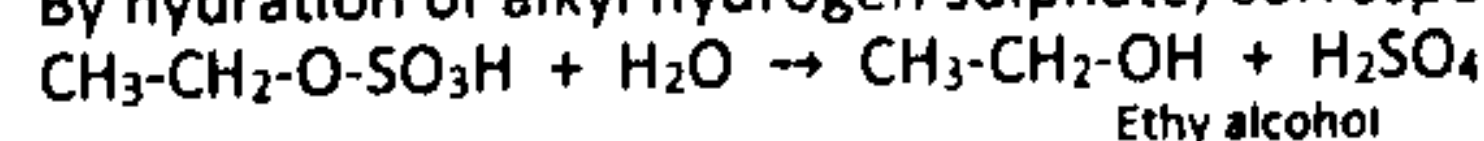
Ans: **Conversion of Ethylene**

(a) Ethylene oxide: $H_2C=CH_2 + 1/2\,O_2 \rightarrow H_2C-CH_2$ (epoxide ring with O)

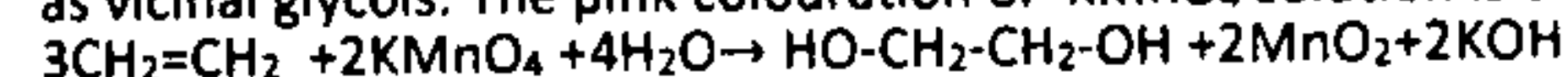
Ethene — Ethylene oxide

(b) Ethylene glycol:

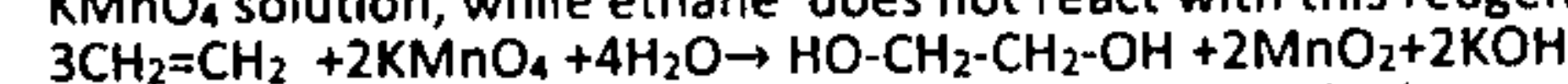
$$3CH_2=CH_2 + 2KMnO_4 + 4H_2O \rightarrow HO\text{-}CH_2\text{-}CH_2\text{-}OH + 2MnO_2 + 2KOH$$

Ethylene glycol

31 Ethene can be converted into ethyl alcohol. Write equation. (3 times)

Ans: When ethane is treated with cold concentrated sulphuric acid, they are dissolved because they react by addition to form alkyl hydrogen sulphate. For example,
$CH_2=CH_2 + H_2SO_4 \rightarrow CH_3\text{-}CH_2\text{-}O\text{-}SO_3H$ (Alkyl hydrogen sulphate)
By hydration of alkyl hydrogen sulphate, corresponding alcohol is produced.
$CH_3\text{-}CH_2\text{-}O\text{-}SO_3H + H_2O \rightarrow CH_3\text{-}CH_2\text{-}OH + H_2SO_4$ (Ethy alcohol)

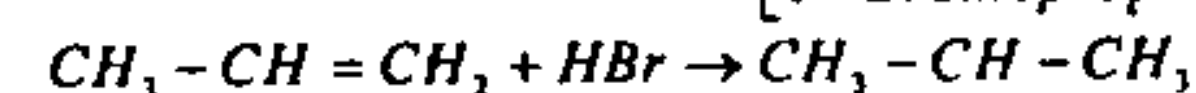
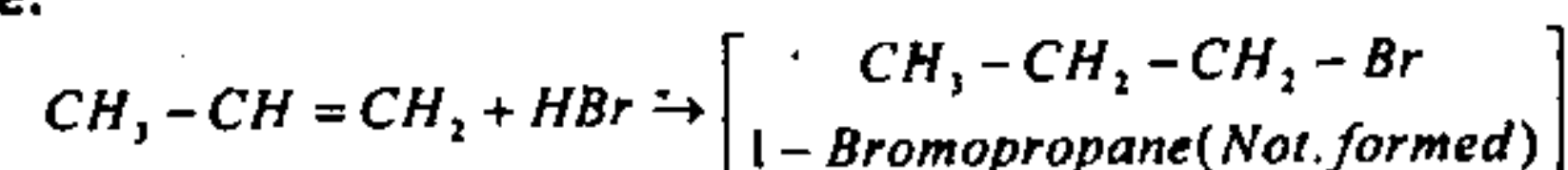
32 What is Baeyer's test? What is its uses? (8 times)

Ans: **Baeyer's test:-** When alkenes are treated with mild oxidizing reagents like dilute alkaline $KMnO_4$ solution (Bayer's Reagent) at low temperature, hydroxylation of double bond occurs resulting in the formation of dihydroxy compounds known as vicinal glycols. The pink colouration of $KMnO_4$ solution is discharged.
$3CH_2=CH_2 + 2KMnO_4 + 4H_2O \rightarrow HO\text{-}CH_2\text{-}CH_2\text{-}OH + 2MnO_2 + 2KOH$ (Ethylene glycol)
Uses: It is a test for the presence of unsaturation in the molcules.

33 Describe how we can be distinguish between ethane ðene? (4 times)

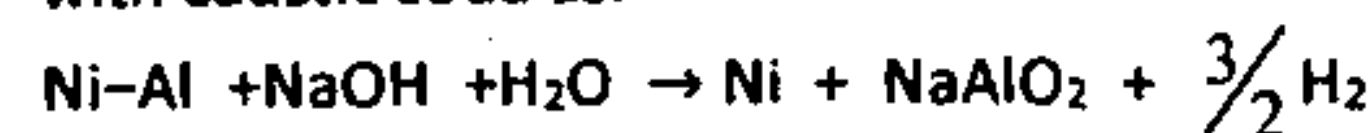
Ans: **Test for ethane and ethane:-** Ethene immediately decolourise the pink colour of $KMnO_4$ solution, while ethane does not react with this reagent.
$3CH_2=CH_2 + 2KMnO_4 + 4H_2O \rightarrow HO\text{-}CH_2\text{-}CH_2\text{-}OH + 2MnO_2 + 2KOH$ (Ethylene glycol)

34 Explain Markownikov's rule with one example? (15 times)

Ans: **Markownikov's rule:-** In the addition of an unsymmetrical reagent to an unsymmetrical alkene, the negative part of the adding reagent goes to that carbon, constituting the double bond, which has least number of hydrogen atoms is calledMarkownikov's rule.
Example:

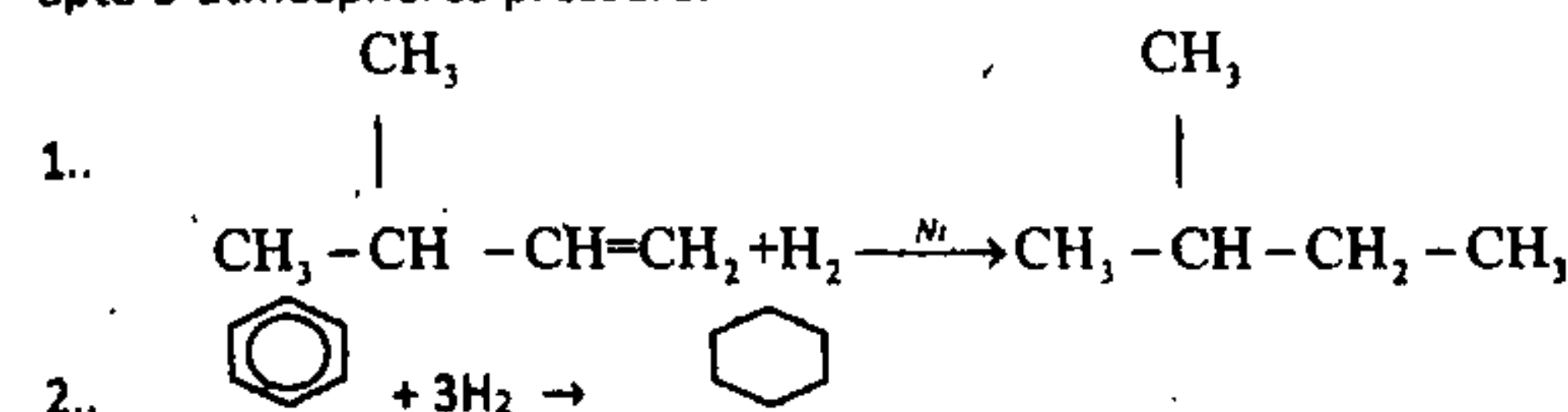
$$CH_3-CH=CH_2 + HBr \rightarrow \left[\begin{array}{c} CH_3-CH_2-CH_2-Br \\ 1\text{-}Bromopropane(Not.formed) \end{array} \right]$$

$$CH_3-CH=CH_2 + HBr \rightarrow CH_3-CH(Br)-CH_3$$

2-bromopropane (Actual..product)

35 Define Rany nickel. Give its uses? (6 times)

Ans: **Rany nickel:-** Rany nickel is a catalyst which is prepared by treating a Ni-Al alloy with caustic soda as:
$Ni\text{-}Al + NaOH + H_2O \rightarrow Ni + NaAlO_2 + \frac{3}{2}H_2$

Uses: Most alkenes are hydrogenated over Raney nickel at about 100ºC and upto 3-atmospheres pressure.

1.. $CH_3-CH(CH_3)-CH=CH_2 + H_2 \xrightarrow{Ni} CH_3-CH(CH_3)-CH_2-CH_3$

2.. Benzene $+ 3H_2 \rightarrow$ Cyclohexane

36 Identify the actual product, when HBr is added to propene. Write equation also.

Ans: Propene is an unsymmetrical alkene. According to Markovnikov's rule, the negative part of the adding reagent goes to that carbon, constituting the double bond, which has least number of hydrogen atoms. The actual product will be.

$$CH_3-CH=CH_2+HBr\rightarrow CH_3-\underset{\displaystyle Br}{\underset{|}{CH}}-CH_3$$

2 – bromopropane

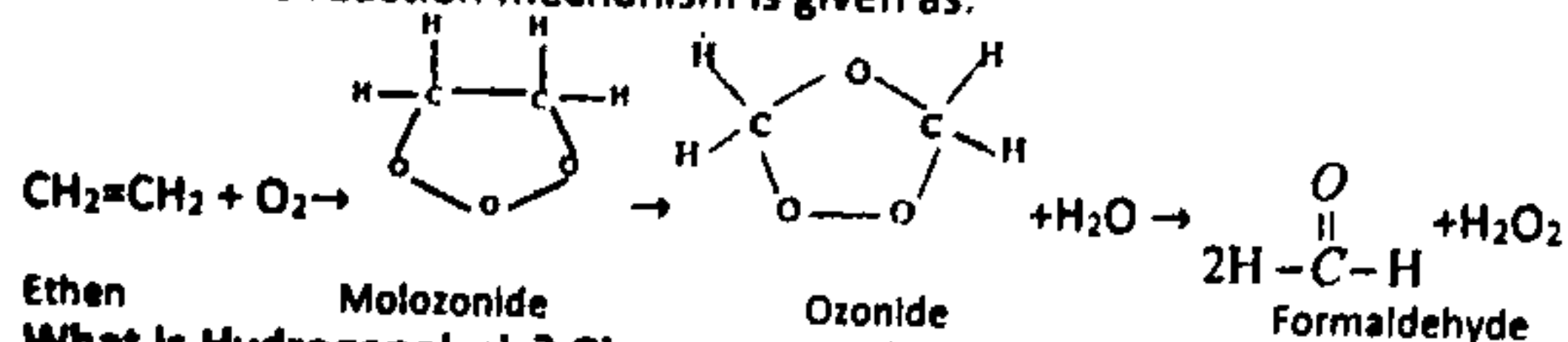
37 Define hydrogenation? Give its two applications.

Ans: **Hydrogenation:-** Hydrogenation is a process in which a molecule of hydrogen is added to an alkene in the presence of a catalyst and at moderate pressure (1-5 atm) to give a saturated compound. It is a highly exothermic process and the amount of heat evolved when one mole of an alkene is hydrogenated is called Heat of Hydrogenation. Hydrogenation reaction is catalyzed by some catalysts like Pt, Pd and Raney nickel.

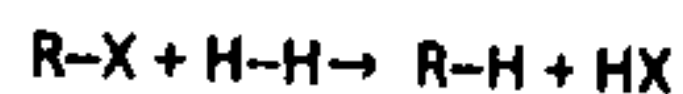
38 Give the mechanism of ozonolysis of ethene? **(4 times)**

Ans: Ozone is highly reactive allotropic form of oxygen. It reacts vigorously with alkenes to form unstable molozonide. It rearrange spontaneously to form an ozonide. The reaction mechanism is given as:

$CH_2=CH_2+O_3\rightarrow$ Molozonide $\rightarrow$ Ozonide $+H_2O\rightarrow 2H-\overset{O}{\overset{||}{C}}-H+H_2O_2$

Ethen — Molozonide — Ozonide — Formaldehyde

39 What is Hydrogenolysis? Give an example. **(4 times)**

Ans: **Hydrogenolysis:-** Hydrogenation along with bond cleavage is called Hydgrogenolysis. This reaction takes place in presence of heated palladium charcoal catalyst. E.g.

$$R-X+H-H\rightarrow R-H+HX$$

40. Describe polymerization of ethene.

Ans: In this process small organic molecules (monomers) combine together to form larger molecules known as polymers.

Ethene at 400°C and 100atm pressure, polymerization to polythene or polyethylene.

$$n(CH_2=CH_2)\xrightarrow{400°C,\,100atm,\,pressure}[CH_2=CH_2]_n$$

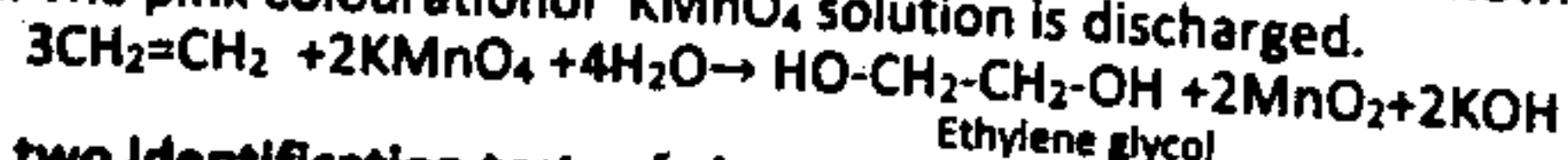
polyethylene

A good quality polythene is obtained, when ethane is polymerized in the presence of aluminium triethyl ($Al(C_2H_5)_3$) and titanium tetrachloride catalysts ($TiCl_4$).

41. Describe a test for the presence of unsaturation in organic molecules.

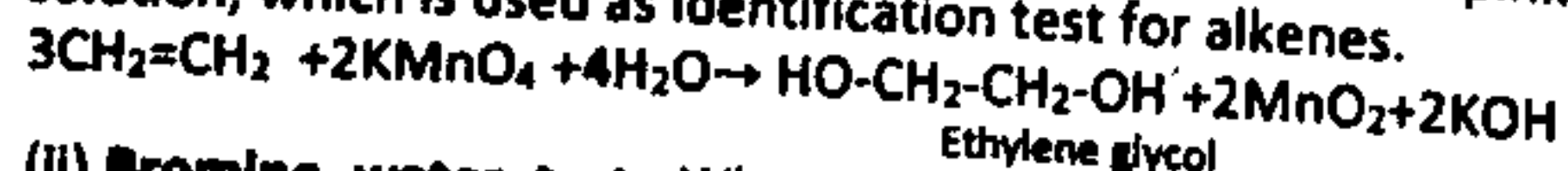
Ans: When alkenes are treated with mild oxidizing reagents like dilute alkaline $KMnO_4$ solution (Bayer's Reagent) at low temperature, hydroxylation of double bond occurs resulting in the formation of dihydroxy compounds known as vicinal glycols. The pink colourationof $KMnO_4$ solution is discharged.

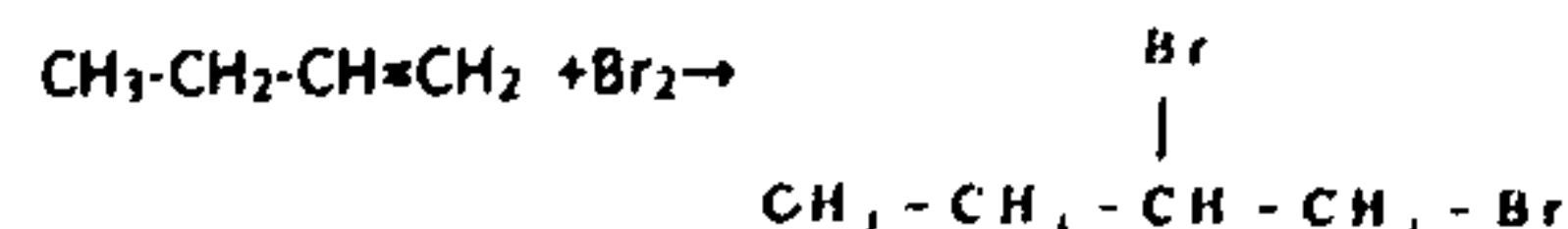
$$3CH_2=CH_2+2KMnO_4+4H_2O\rightarrow HO\text{-}CH_2\text{-}CH_2\text{-}OH+2MnO_2+2KOH$$

Ethylene glycol

42 Write two identification tests of akenes.

Ans (i). **Bayer's Test:** Ethene immediately decolourise the pink colour of $KMnO_4$ solution, which is used as identification test for alkenes.

$$3CH_2=CH_2+2KMnO_4+4H_2O\rightarrow HO\text{-}CH_2\text{-}CH_2\text{-}OH+2MnO_2+2KOH$$

Ethylene glycol

(ii). **Bromine water test:** When alkenes react with bromine water its brown colour disappears. Which is used for the identification test for alkenes.

$$CH_3\text{-}CH_2\text{-}CH=CH_2+Br_2\rightarrow CH_3-CH_2-\underset{}{\overset{\displaystyle Br}{\overset{|}{CH}}}-CH_2-Br$$

43 How will you prepare following compounds from ethene?

(a) ethyl alcohol **(b) ethylene epoxide**

Ans (a) When etheneis treated with cold concentrated sulphuric acid, they are dissolved because they react by addition to form alkyl hydrogen sulphate. For example,

$$CH_2=CH_2+H_2SO_4\rightarrow CH_3\text{-}CH_2\text{-}O\text{-}SO_3H$$

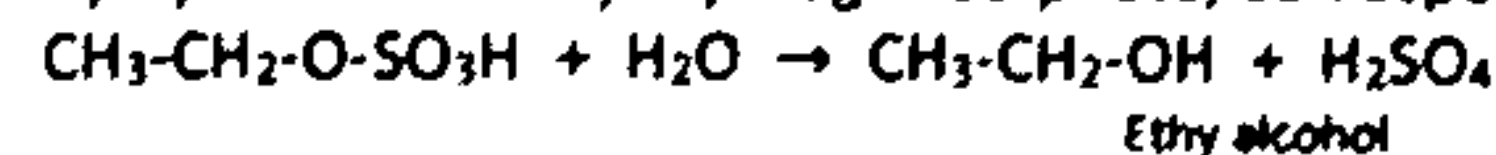
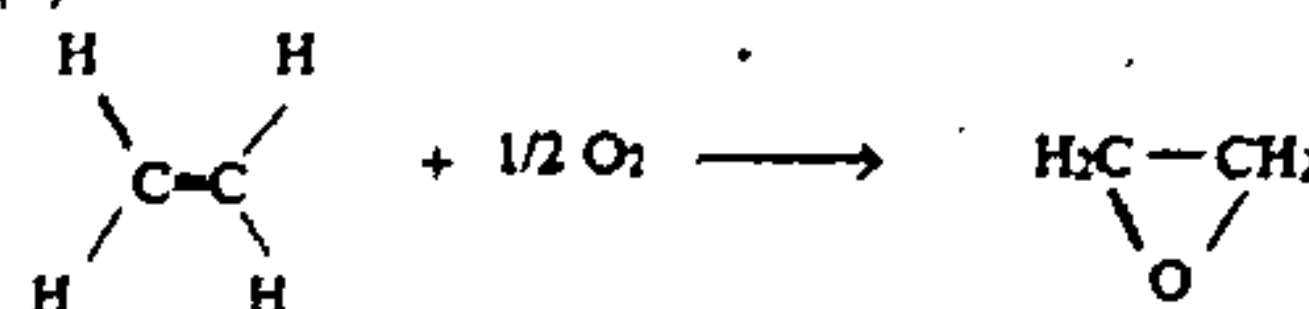
Alkyl hydrogen sulphate

By hydration of alkyl hydrogen sulphate, corresponding alcohol is produced.

$$CH_3\text{-}CH_2\text{-}O\text{-}SO_3H+H_2O\rightarrow CH_3\text{-}CH_2\text{-}OH+H_2SO_4$$

Ethy alcohol

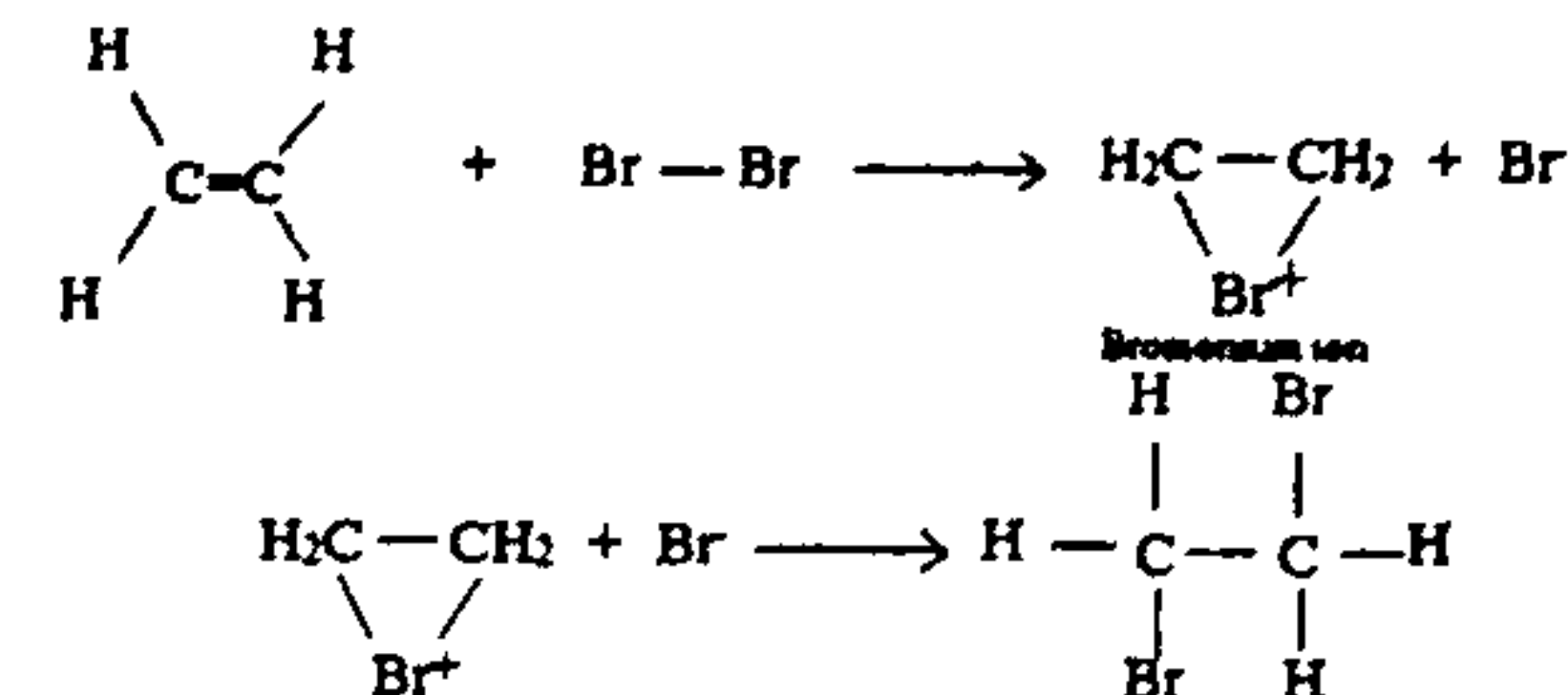
(b)

$H_2C=CH_2+1/2\,O_2\longrightarrow H_2C-CH_2$ (epoxide ring, O bridging)

Ethene — Ethylene epoxide

44 Give the mechanism of bromination of ethene. **(2 times)**

Ans

$H_2C=CH_2+Br-Br\longrightarrow H_2C-CH_2$ (bridged Br^+, Bromonium ion) $+Br^-$

H_2C-CH_2 (bridged Br^+) $+Br^-\longrightarrow H-\overset{H}{\underset{Br}{C}}-\overset{Br}{\underset{H}{C}}-H$

Topic No: 8.4.5: Uses of Ethene:

45 Mention four uses of ethene. **(2 times)**

Ans: Ethene is used:

(i). for the manufacture of polythene, a plastic material used of making toys, cables, bags, boxes, etc.

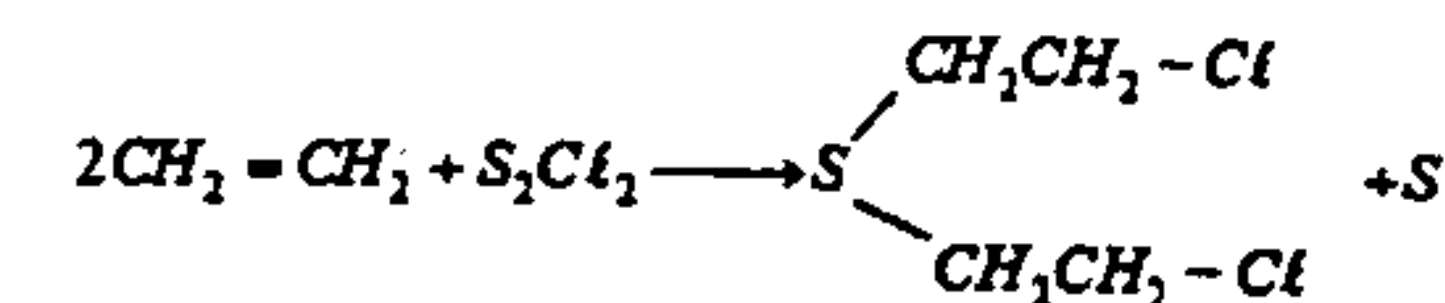
(ii). for a artificial ripening of the fruits.

(iii). as a general anesthetic.

(iv). for preparing 'Mustard gas' a chemical used in Word War I, the name comes from its mustard like odour, it is not a gas, but a high boiling liquid that is dispersed as a mist of tiny droplets.

46. What is Mustard gas? How is it produced.

Ans: Mustard gas is chemical used in world war I. It is not a gas but high boiling liquid, causes blisters.

$$2CH_2=CH_2+S_2Cl_2\longrightarrow S\begin{cases}CH_2CH_2-Cl\\CH_2CH_2-Cl\end{cases}+S$$

Topic No: 8.5: Alkynes:

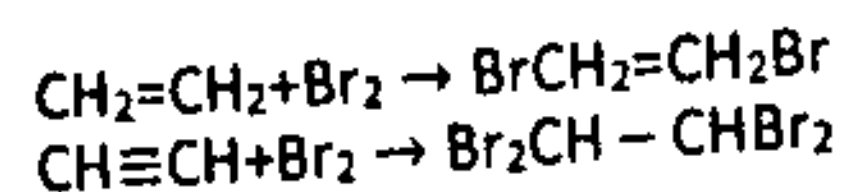
47 Write structural formulas for two compound; (i). Vinyl acetylene (ii).But-3-en-yne

Ans: (i).. Vinyl acetylene : $CH_2=CH-C\equiv CH$

(ii).. 1-Butene-3-yne: $CH_2=CH-C\equiv CH$

48 Distinguish between Ethene and Acetylene?

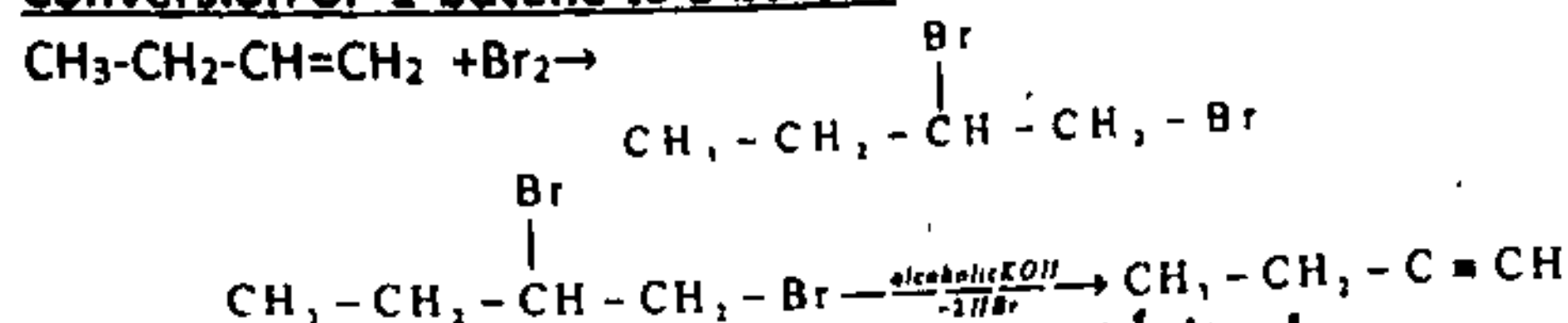
Ans: <u>Difference of Ethene and Acetylene:</u>-Ethene discharges colour of Br_2 immediately while acetylene reacts slowly with Br_2 and colour of Br_2 is discharged in few minutes.

$$CH_2{=}CH_2 + Br_2 \rightarrow BrCH_2{=}CH_2Br$$
$$CH{\equiv}CH + Br_2 \rightarrow Br_2CH - CHBr_2$$

(3 times)

49 How will you convert 1-butene to 1-butyne?

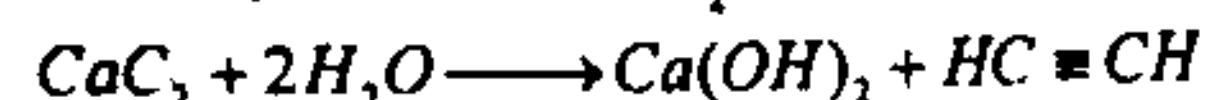
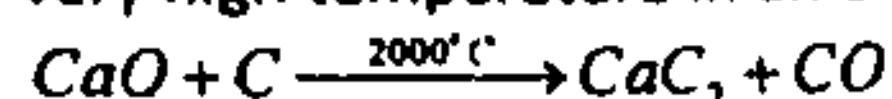
Ans: <u>Conversion of 1-butene to 1-butyne</u>

$$CH_3{-}CH_2{-}CH{=}CH_2 + Br_2 \rightarrow CH_3{-}CH_2{-}\underset{}{\overset{Br}{\overset{|}{C}}}H{-}CH_2{-}Br$$

$$CH_3{-}CH_2{-}\overset{Br}{\overset{|}{C}}H{-}CH_2{-}Br \xrightarrow[-2HBr]{alcoholic\,KOH} CH_3{-}CH_2{-}C{\equiv}CH$$

Topic No: 8.5.3: General Preparation Methods:

50 How can ethyne be prepared commercially from calcium carbide?

Ans: On industrial scale ethyne is prepared by the reaction of calcium carbide (CaC_2) with water. Calcium carbide is prepared by heating lime (CaO) and coke (C) at a very high temperature in an electric furnace.

$$CaO + C \xrightarrow{2000^\circ C} CaC_2 + CO$$
$$CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + HC{\equiv}CH$$

51. Why Alkynes are less reactive than alkenes towards Electrophilic Regents?

Ans: A π-bond in alkenes is not only weak but its electrons are more expose to an attack by an electrophilic reagent. Both these acts make the alkenes a very reactive class of compounds. Alkynes although contain two π-bond are less reactive than alkenes towards electrophilic reagents this is because the bond distance between the two triple bonded carbon atoms is very short and hence the π-electrons are not available to be attacked by electrophilic reagents.

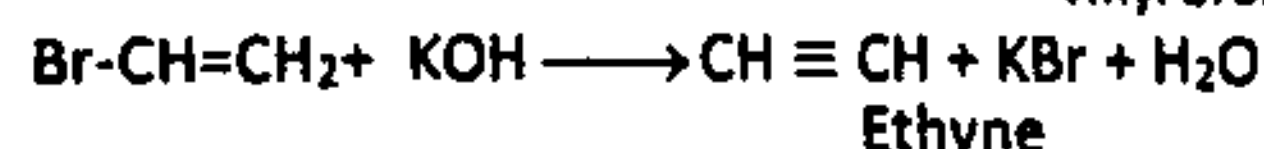
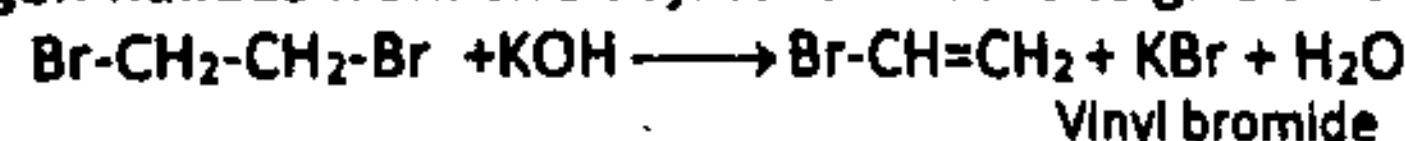
Topic No: 8.5.4: Reactions:

52. How are alkynes prepared from vicinal dihalides?

Ans: <u>Preparation of Alkyne:</u>

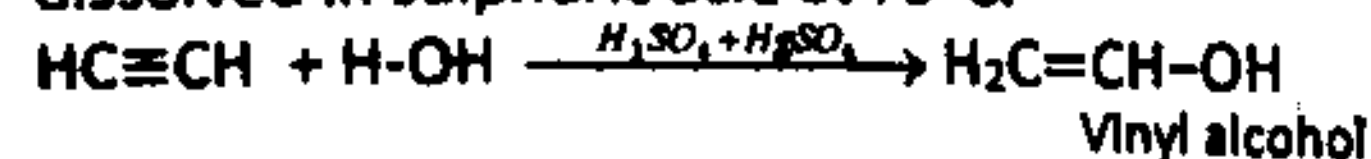
Vicinaldihalide on treating with a strong base eliminates two molecules of hydrogen halides from two adjacent carbons to give an alkyne.

$$Br{-}CH_2{-}CH_2{-}Br + KOH \longrightarrow \underset{\text{Vinyl bromide}}{Br{-}CH{=}CH_2} + KBr + H_2O$$

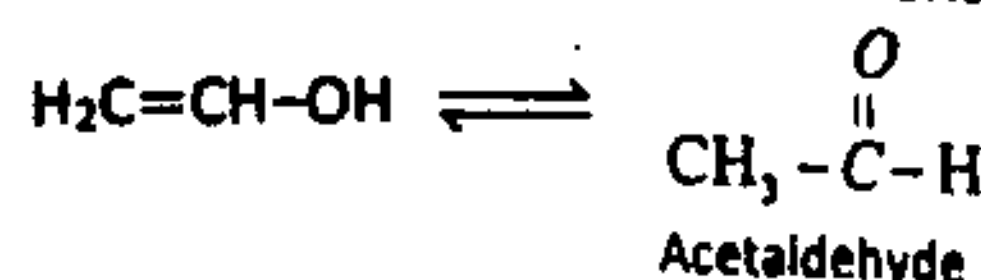
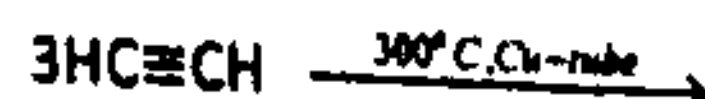
$$Br{-}CH{=}CH_2 + KOH \longrightarrow \underset{\text{Ethyne}}{CH \equiv CH} + KBr + H_2O$$

53 How ethyne (actylene) is converted to (a). Acetaldehyde (b) Benzene? (6 times)

Ans: Conversion of ethyne is in to

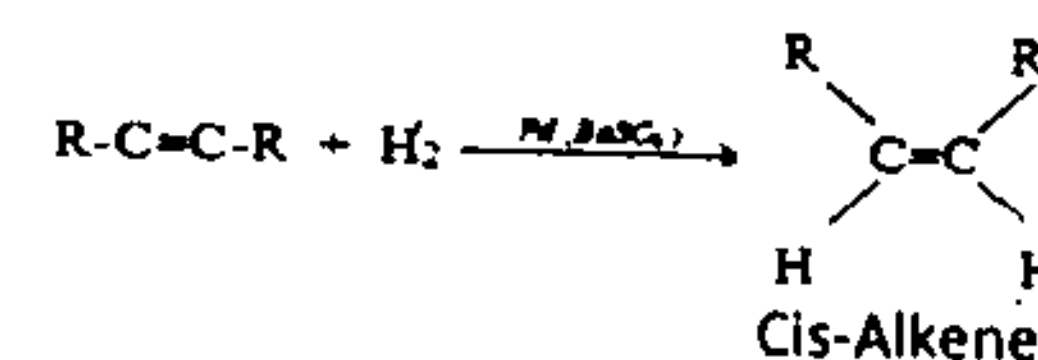
(a).. **Acetaldehyde:**Water adds to ethyne in the presence of mercuric sulphate dissolved in sulphuric acid at 75ºC.

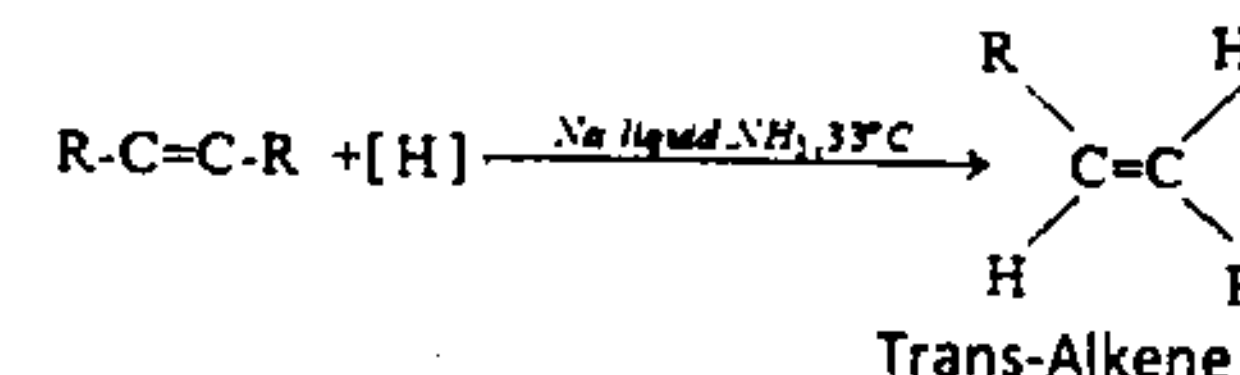
$$HC{\equiv}CH + H{-}OH \xrightarrow{H_2SO_4 + HgSO_4} \underset{\text{Vinyl alcohol}}{H_2C{=}CH{-}OH}$$

Vinyl alcohol is an unstable enole. The enol has the hydroxy group attached to double bonded carbon atom and isomerises to acetaldehyde.

$$H_2C{=}CH{-}OH \rightleftharpoons \underset{\text{Acetaldehyde}}{CH_3{-}\overset{O}{\overset{\|}{C}}{-}H}$$

(b).. **Benzene:-** $3HC{\equiv}CH \xrightarrow{300^\circ C, Cu\text{-}tube}$ (benzene ring)

54 How Cis and Trans Alkenes are obtained from Alkynes? (3 times)

Ans: Controlled hydrogenation of alkynes with hydrogen gas in an equimolar ratio over heated catalysts, gives alkenes. The catalyst is finely divided palladium supported on $BaSO_4$ and poisoned by treated with quinolone (Lindlar's catalyst).

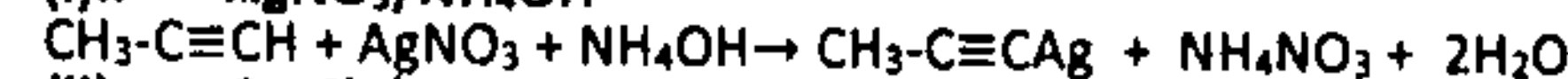
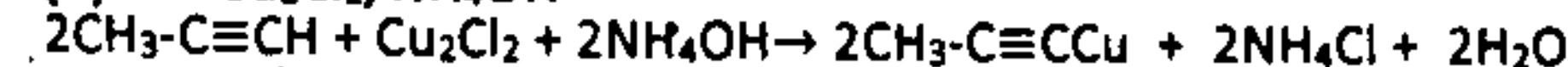
$$R{-}C{\equiv}C{-}R + H_2 \xrightarrow{Pd, BaSO_4} \underset{\text{Cis-Alkene}}{(R)(H)C{=}C(R)(H)}$$

A trans alkene can be obtained by treating an alkyne with Na in liquid NH_3 at -33 ºC.

$$R{-}C{\equiv}C{-}R + [H] \xrightarrow{Na\ liquid\ NH_3, 33^\circ C} \underset{\text{Trans-Alkene}}{(R)(H)C{=}C(H)(R)}$$

55 How does propyne react with :(I).. $AgNO_3/NH_4OH$ (II).. Cu_2Cl_2/NH_4OH

Ans: (I).. $AgNO_3/NH_4OH$

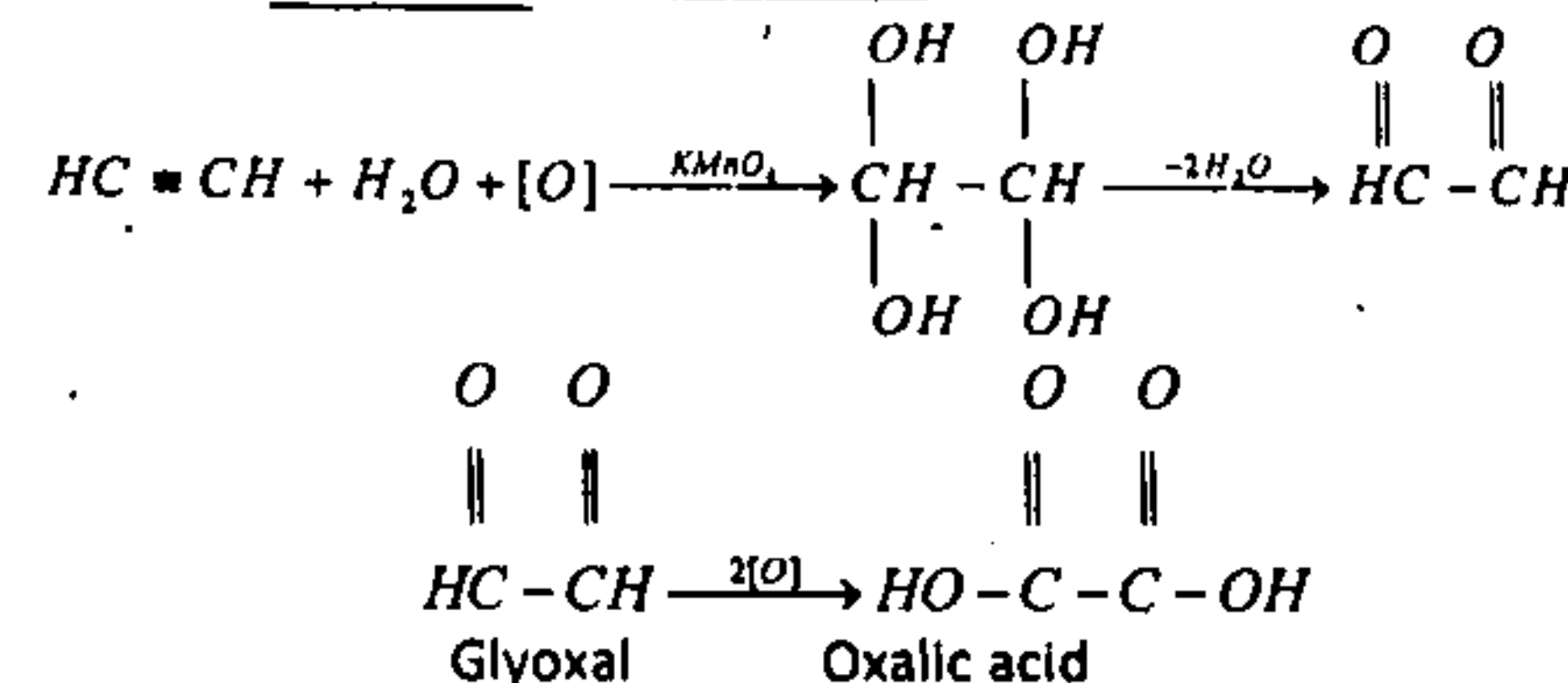
$$CH_3{-}C{\equiv}CH + AgNO_3 + NH_4OH \rightarrow CH_3{-}C{\equiv}CAg + NH_4NO_3 + 2H_2O$$

(II).. Cu_2Cl_2/NH_4OH

$$2CH_3{-}C{\equiv}CH + Cu_2Cl_2 + 2NH_4OH \rightarrow 2CH_3{-}C{\equiv}CCu + 2NH_4Cl + 2H_2O$$

56 Convert $HC \equiv CH$ into oxalic acid. (2 times)

Ans: <u>Conversion of $HC \equiv CH$ into oxalic acid:</u>

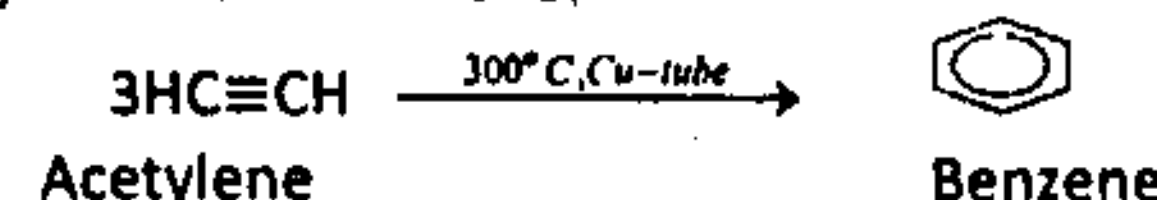
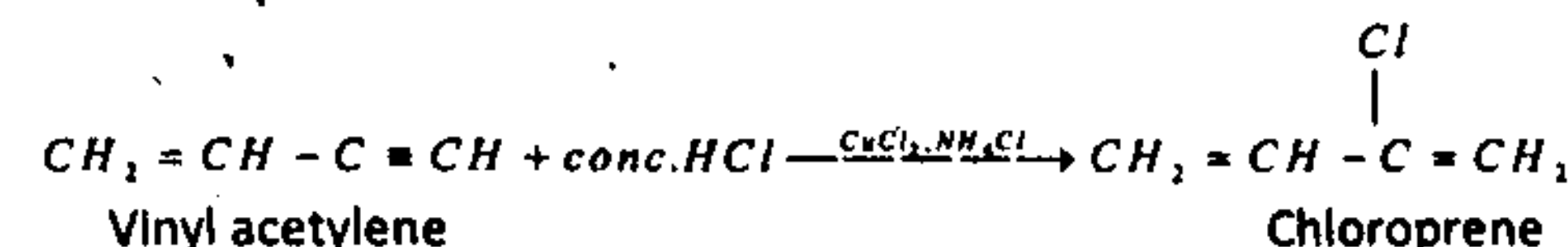
$$HC \equiv CH + H_2O + [O] \xrightarrow{KMnO_4} \underset{OH\ \ OH}{\overset{OH\ \ OH}{CH - CH}} \xrightarrow{-2H_2O} \overset{O\ \ O}{\overset{\|\ \ \|}{HC - CH}}$$

$$\underset{\text{Glyoxal}}{\overset{O\ \ O}{\overset{\|\ \ \|}{HC - CH}}} \xrightarrow{2[O]} \underset{\text{Oxalic acid}}{HO - \overset{O}{\overset{\|}{C}} - \overset{O}{\overset{\|}{C}} - OH}$$

57. How will you synthesize following compounds from ethyne.: (a) Benzene (b) Chloroprene.

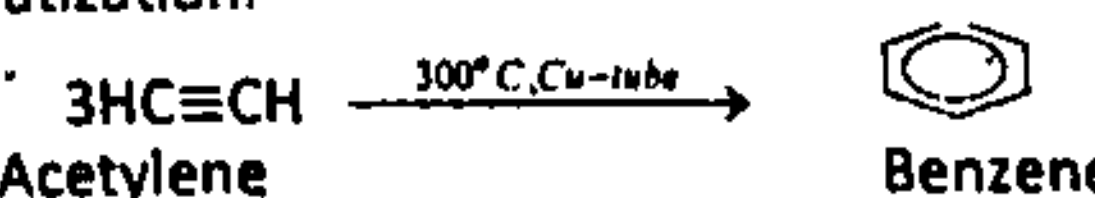
Ans: (a). **Benzene:**-When acetylene is passed through a copper tube at 300°C it polymerizes to benzene.

$$\underset{\text{Acetylene}}{3HC{\equiv}CH} \xrightarrow{300^\circ C, Cu\text{-}tube} \text{Benzene}$$

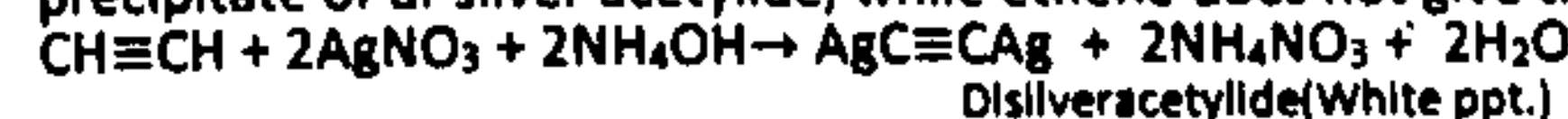
(b).. **Chloroprene:-**

$$\underset{\text{Vinyl acetylene}}{CH_2 = CH - C \equiv CH} + conc.HCl \xrightarrow{CuCl_2, NH_4Cl} \underset{\text{Chloroprene}}{CH_2 = CH - \overset{Cl}{\overset{|}{C}} = CH_2}$$

58. What is aromatization?

Ans: <u>Aromatization:</u>To develop aromatic character in cyclic rings is called aromatization.

$$\underset{\text{Acetylene}}{3HC{\equiv}CH} \xrightarrow{300^\circ C, Cu\text{-}tube} \text{Benzene}$$

59 Distinguish between ethane & ethyne by a chemical test? (3 times)

Ans: When ethyne passed through ammonical solution of $AgNO_3$, it forms white precipitate of di-silver acetylide, while ethene does not give this test.

$$CH{\equiv}CH + 2AgNO_3 + 2NH_4OH \rightarrow \underset{\text{Disilveracetylide(White ppt.)}}{AgC{\equiv}CAg} + 2NH_4NO_3 + 2H_2O$$

60 Explain acidic nature of ethyne?

Ans: <u>Acidic nature of ethyne</u>Inethyne, the hydrogen atom is bonded to the carbon atom with sp-s overlap. The sp hybridized carbon atom of ethyne pulls the electrons more strongly making the attached hydrogen atom slightly acidic as:

$$H - C \equiv C^{-\delta} - H^{+\delta}$$

61. How would you prepare acetone from propyne.

Ans: $3\ HC\equiv CH + H^+ \xrightarrow{HgSO_4, H_2SO_4} H_2C=CH\text{-}O\text{-}H$

Vinyl alcohol is an unstable enol. The enol has the hydroxyl group attached to a doubly bonded carbon atom and isomerizes to acetaldehyde.

$H_2C=CH\text{-}O\text{-}H \rightleftharpoons H_3C\text{-}CO\text{-}H$

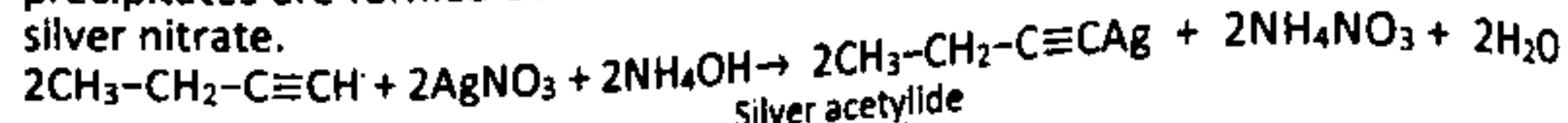
All other alkynes give ketones;

$HC\equiv CH\text{-}CH_3 + H_2O \xrightarrow{HgSO_4, H_2SO_4} H_3C\text{-}CO\text{-}CH_3$

62 How ammonical solution $AgNO_3$ can be used distinguish between 1-Butyne and 2-Butyne?

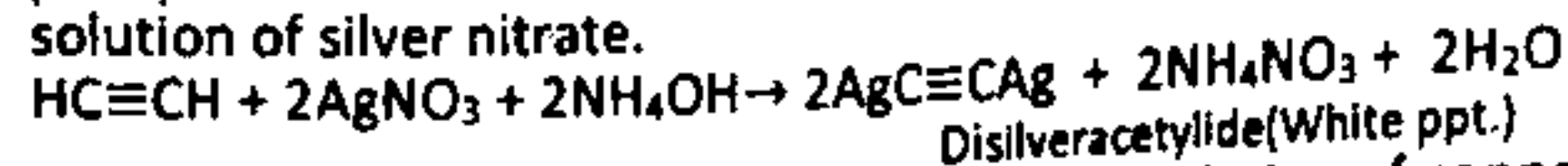
Ans: When 1-butyne is treated with ammonical solution of silver nitrate white precipitates are formed but 2-butyne does not react with ammonical solution of silver nitrate.

$2CH_3\text{-}CH_2\text{-}C\equiv CH + 2AgNO_3 + 2NH_4OH \rightarrow 2CH_3\text{-}CH_2\text{-}C\equiv CAg + 2NH_4NO_3 + 2H_2O$

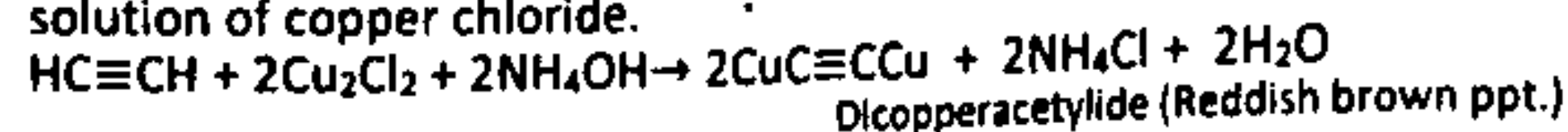
Silver acetylide

63 Write two identification tests of 1- Alkynes.

Ans (i) When 1-alkyne is treated with ammonical solution of silver nitrate white precipitates are formed but other alkynes does not react with ammonical solution of silver nitrate.

$HC\equiv CH + 2AgNO_3 + 2NH_4OH \rightarrow 2AgC\equiv CAg + 2NH_4NO_3 + 2H_2O$

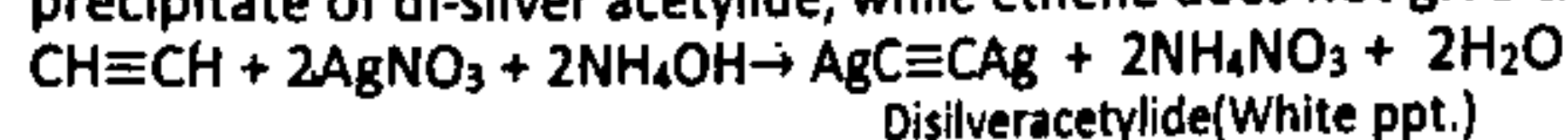
Disilveracetylide(White ppt.)

(ii). When 1-alkyne is treated with ammonical solution of copper chloride reddish brown precipitates are formed but other alkynes does not react with ammonical solution of copper chloride.

$HC\equiv CH + 2Cu_2Cl_2 + 2NH_4OH \rightarrow 2CuC\equiv CCu + 2NH_4Cl + 2H_2O$

Dicopperacetylide (Reddish brown ppt.)

64. How does ethyne react with ammonical silver nitrate?

Ans: When ethyne passed through ammonical solution of $AgNO_3$, it forms white precipitate of di-silver acetylide, while ethene does not give this test.

$CH\equiv CH + 2AgNO_3 + 2NH_4OH \rightarrow AgC\equiv CAg + 2NH_4NO_3 + 2H_2O$

Disilveracetylide(White ppt.)

Topic No: 8.6: Comparison of Reactivities:

65 Alkanes are less reactive than alkenes. Comment? (3 times)

Ans: The alkanes or paraffins (Latin: parum= little, affins = affinity) under ordinary condition are inert towards acids, alkalis, oxidizing and reducing agents. The unreactivity of alkanes can also be explained on the basis of inertness of a σ-bond. In a σ-bond the electrons are very tightly held between the nuclei which makes it is very stable bond. A lot of energy is required to break it.

On the other hand alkenes contains π-bond, having partially filled p-orbitals overlap in a parallel fashion. π-electrons are less firmly held between the nulei. In alkenes a π-bond is, therefore, a weak bond as compared to a σ-bond.

66 Why alkenes are more reactive than alkanes and alkynes?

Ans: The unreactivity of alkanes can also be explained on the basis of inertness of a σ-bond. In a σ-bond the electrons are very tightly held between the nuclei which makes it very stable bond. A lot of energy is required to break it.

On the other hand alkenes contains π-bond, having partially filled p-orbitals overlap in a parallel fashion. π-electrons are less firmly held between the nulei. In alkenes a π-bond is, therefore, a weak bond as compared to a σ-bond.

In alkynes, the carbon atoms are held together by a triple bond, a σ-bond and two π-bonds. The electron density between the carbon atoms is very high which draws atoms very close to each other. Electrons in a triple bond are, therefore, less exposed and thus less reactive towards reagents than alkenes.

67 Why ethene is more reactive than ethyne towards addition reactions?

Ans: Ethene contains π-bond, having partially filled p-orbitals overlap in a parallel fashion. π-electrons are less firmly held between the nulei. In ethene a π-bond is a weak bond.

In ethyne, the carbon atoms are held together by a triple bond, a σ-bond and two π-bonds. The electron density between the carbon atoms is very high which draws atoms very close to each other. Electrons in a triple bond are, therefore, less exposed and thus less reactive towards reagents.

LONG QUESTIONS OF CHAPTER-8
ALIPHATIC HYDROCARBON
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 8.3.1

1. Write two methods for the preparation of Alkanes from Alkyl halides. (2 times)

Ans: (Text Book Page No:143)

2. Explain with equations how Alkanes can be prepared from (i) Acids

Ans: (Text Book Page No:143)

3. Prepare Ethane From Kolbe's Electrolytic method. Also write down its mechanism.

Ans: (Text Book Page No:144)

Topic No: 8.3.4/4

4. Explain free radical mechanism for the reaction of chlorine with methane in the presence of sunlight. (2 times)

Ans: (Text Book Page No:147)

5. Write a note on halogenations of alkanes.

Ans: (Text Book Page No:148)

Topic No: 8.4.1

6. Discuss any two method of preparation of alkenes. (3 times)

Ans: (Text Book Page No:149)

Topic No: 8.4.4

7 Write balanced equations for the reactions of ethenewith:
(i) O_2/Ag (ii) S_2Cl_2 (iii) $KMnO_4$ (iv) HOCl

Ans: (Text Book Page No:i-155,ii-157.iii-155.iv-155)

8. Write the chemical reaction of ethene with the following.
(i) HCl (ii) Br_2 (iii) O_3 (iv) HOX

Ans: (Text Book Page No:153+156)

9 Write the reactions of ethene with:
(i) Br_2 (ii) O_3 (iii) HBr (iv) HOCl

Ans: (Text Book Page No:i-154.ii-156.iii-153,iv-155)

10 Write the reaction of propene with:
(i) H_2/Ni (ii) Cone.H_2SO_4 (iii) HCl (iv) HOCl

Ans: (Text Book Page No:i-152,ii-154.iii-153.iv-155)

11 Write the reactions of ethene with: (i) HOCℓ (ii) dilute $KmnO_4$ (iii) Ozone (iv) $S_2C\ell_2$

Ans: (Text Book Page No:154)

12 What happened when ethene is reacted with $KMnO_4$, HBr and S_2Cl_2.

Ans: (Text Book Page No:155+153+157)

13 What is Markownikov'sRule? Give two examples. (2 times)

Ans: (Text Book Page No:153)

14. How will you convert ethane into:
(i) Ethyl alcohol (ii) Ethylene epoxide (iii) Ethylene glycol (iv)Ethylene chlorohydrins.

Ans: (Text Book Page No:154+155)

15 How will you make the following conversion.
(i) Ethene into ethanol (ii) Ethanol into 2-Butanone

Ans: (Text Book Page No:154)

16 How will you make the following conversions from an alkene;
(i) 2-Bromopropane. (ii) 2- Bromo-2methylpropane
(iii) 2-propanol (iv) propylene oxide

Ans: (Text Book Page No:154)

17 Give the chemical reactions of ethenewith:
(i)O_2 in the presence of Ag_2O (ii) Conc. H_2SO_4 (iii) S_2Cl_2 (iv) HOCl .
Ans: (Text Book Page No:152)

Topic No: 8.5

18 Starting from ethene, outline the reactions for preparation of the following compounds.
(i) 1,2dibromoethane ii) Ethyne (iii) Ethane (iv) Ethylene glycol
Ans: (Text Book Page No:i-154, ii-157,iii-143,iv-155)

Topic No: 8.5.1

19 How Kolb's electrolysis method is used for preparation of alkenes & alkynes (2 times)
Ans: (Text Book Page No:150)
20 Give the preparation of ethyne by:
Dehydrohalogenation of vicinal dihalide (ii) Kolbe's electrolytic method
Ans: (Text Book Page No:157+158)
21 Describe mechanism for the electrolysis of potassium maleate to prepare ethyne.
Ans: (Text Book Page No:158)

Topic No: 8.5.4

22 Discuss acidic nature of alkynes with at least two examples. (7 times)
Ans: (Text Book Page No:162)
23 Show the reactions that ethene and ethyne are unsaturated. How can they distinguished? Complete also the corresponding chemical reaction. (2 times)
Ans: (Text Book Page No:152+159)
24 Write a note on polymerization of ethyne. (4 times)
Ans: (Text Book Page No:161)
25 Describe how you could distinguished ethane, ethene and ethyne from one another by means of chemical reactions.
Ans: (Text Book Page No:146+152+159)
26 How does ethyne react with:
(i) Hydrogen (ii) Halogen acid (iii) Alkaline $KMnO_4$
Ans: (Text Book Page No:i-159.ii-160.iii-161)
27. Write chemical equations of reactions of ethynewith.
(i) Cl_2 (ii) HCN (iii) NH_3 (iv) $H_2O \xrightarrow[H_2SO_4]{HgSO_4}$
Ans: (Text Book Page No:160+161+162)
28. How will you Synthesize the following compounds starting from ethyne.
(i) Chloroprene (ii) Glyoxal (iii) Methyl nitrile (iv) Acetaldehyde
Ans: (Text Book Page No:160+161+162)
29. How will you distinguish ethane, ethene and ethyne.
Ans: (Text Book Page No:143+150+157)
30. How acetylene can be converted into
(i) Acetaldehyde (ii) Chloroprene (iii) Acrylonitrile (iv) Divinyl acetylene
Ans: (Text Book Page No:159)
31. How will you convert ethyne to (i). Ethane (ii) Acetaldehyde (iii) Divinyl acetylene (iv) Glyoxal
Ans: (Text Book Page No:143)
32. Make the following changes. (i). Aeration (ii) Ethyne into Benzene
Ans: (Text Book Page No:162)
33. How will you bring about the following conversions?
i) 1- butane into 1 – butyne ii) acetylene into chloroprene
Ans: (Text Book Page No:)
34. Synthesize: i)Oxalic acid ii) Methyl nitrile iii) Acetaldehyde iv) Acrylonitrile starting from ethyne.
Ans: (Text Book Page No:231)

Topic No: 8.5.6

35. Give comparison of reactivates of alkane, alkene and alkyne.
Ans: (Text Book Page No:145+151+159)

2018

36. How will you prepare following from ethyne (Equations only)
(i) Acetaldehyde (ii) Benzene (iii) Ethane (iv) Oxalic acid
Ans: (Text Book Page No:157)
37. How will you bring about the following conversions.
(i) Methane to Ethane (ii) Acetic acid to Ethane
Ans: (Text Book Page No:)
38. Discus the following terms with respect to alkenes with suitable chemical reactions.
(i) Ozonolysis (ii) Hydroxylation
Ans: (Text Book Page No:155+156)
39. Write down the structural formulae for the products formed when 1-butene reacts with
(i) Cold dil. $KMnO_4$ /OH- (ii)HBr (iii) O_2 in the presence of Ag_2O (iv) HOCl
Ans: (Text Book Page No:155)
40. Prepare alkenes from (i) carbonyl compounds (aldehyde and ketones) (ii) Grignard reagent (iii) Alkyl halide
Ans: (Text Book Page No:149)
41. How is ethyne react with:
(i) Alkaline $KMnO_4$ (ii) 10% H_2SO_4(iii) HBr (iv) NH_3
42. Describe preparation of ethane (CH_3-CH_3) by each of the following methods:
(i) By carboxylation of monocarboxylic acid (ii) by Kolbe electrolysis method

OBJECTIVES (MCQ'S) OF CHAPTER-9
AROMATIC HYDROCARBON
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 9.1

1. Aromatic hydrocarbons are the derivatives of: (2 times)
(a) Normal series of paraffins (b) Alkene (c) Benzene (d) Cyclohexane

Topic No: 9.3

2.Total number of π electrons in benzene are :
(a)3 (b) 6 (c)12 (d)18

Topic No: 9.3.7

3. How many resonance structures of benzene are known:
(a) 3 (b) 4 (c) 5 (d) 6
4. C – C bond length in benzene is: (2 times)
(a) 1.34 A° (b) 1.20 A° (c) 1.39 A° (d) 1.54 A°
5. The Benzene Molecule contains:- (2 times)
(a) Three double bonds (b) Two double bonds
(c) One double bond (d) Delocalized - π electron charge

Topic No: 9.4

6. The conversation of n-hexane to benzene by heating in presence of Pt is called: (4 times)
(a) Isomerization (b) Dealkylation (c) Rearrangement (d) Aromatization

Topic No: 9.5

7.Benzene cannot undergo reactions: (7 times)
(a) Substitution (b) Addition (c) Oxidation (d) Elimination

Topic No: 9.5.2

8. Toluene $\xrightarrow[100\ ^\circ C]{3HNO_3 + H_2SO_4}$ (10 times)
(a) O-nitrotoluene (b) M- nitrotoluene (c) P- nitrotolueue (d) 2,4,6,-TNT

9. During nitration of benzene the active nitrating agent is: (10 times)
(a) NO_3^- (b) NO_2 (c) NO_2^- (d) NO_2^+

10. Which of the following acid can be used as a catalyst in Friedel crafts reaction? (9 times)
(a) $AlCl_3$ (b) HNO_3 (c) $BeCl_2$ (d) NaCl

11. The electrophile used for sulphonation of benzene is: (7 times)
(a) SO_3 (b) SO_4 (c) HSO_4^+ (d) H_2SO_4

Topic No: 9.5.4

12. Ortho, Para derivatives are obtained by halogenations of:
(a) Nitrobenzene (b) Toluene (c) Benzaldehyde (d) Benzene

13. Among the following, the compound that can be sulphonated most easily is: (2 times)
(a) Toluene (b) Benzene (c) Nitrobenzene (d) Chlorobenzene

14. m –Chloronitro benzene is prepared by:
(a) Nitration of Chloro benzene (b) Nitration of Benzene
(c) Nitration of m-Chloro benzene (d) Chlorination of nitro benzene

Topic No: 9.6

15. In the given compounds the most reactive one is: (3 times)
(a) Benzene (b) Ethene (c) Ethane (d) Ethyne

2019

16. Sooty flame on burning aromatic-compound is due to:
(a) High percentage of hydrogen (b) Ring structure
(c) High percentage of carbon (d) Resistant reaction with air

17. Molecular formula of benzyl chloride is:
(a) $H_5C_6CCl_3$ (b) $H_5C_6HCl_2$ (c) $H_5C_6CH_2Cl$ (d) $H_5C_6CH_2.CH_2Cl$

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

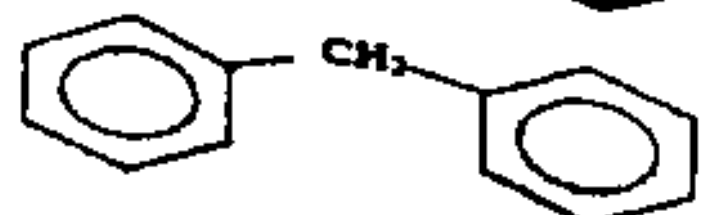
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C	B	C	C	D	D	D	D	D	A	A	B	A	D	B
16	17													
C	C													

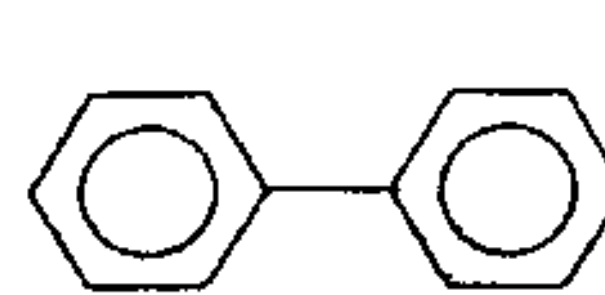
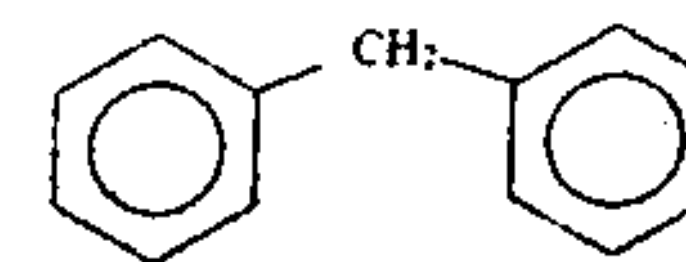
SHORT QUESTIONS OF CHAPTER-9 AROMATIC HYDROCARBON ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 9.1

1. Write structural formulas of: (a) naphthalene. (b) Diphenylmethane.

Ans: (a): Naphthalene

(b): Diphenylmethane

2. **Write the structures of following compounds:**
(a) Biphenyl (b) Diphenylmethane

Ans:

Biphenyl Diphenylmethane

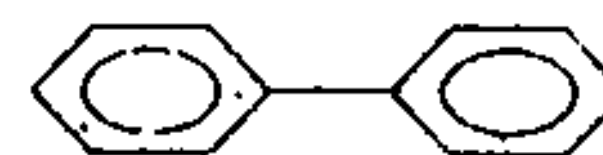
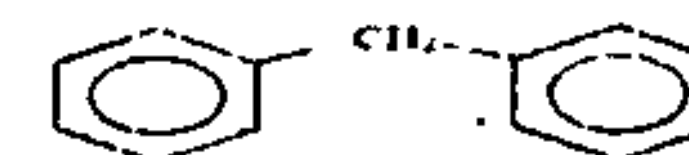
3. **What are aromatic hydrocarbons? Give two examples.**

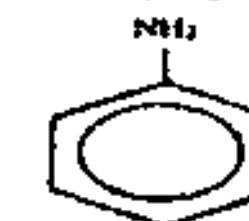
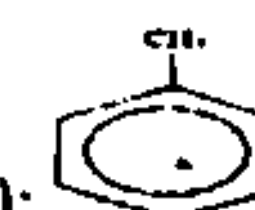
Ans: The carbocyclic compounds containing at least one benzene ring, six carbon atoms with three alternate double and single bonds are called aromatic hydrocarbons. These bonds are usually shown in the form of a circle.
Examples: Toluene, Phenol, Benzaldehyde and Nitrobenzene.

4. **What are monocyclic and polycyclic aromatic Hydrocarbons? (4 times)**

Ans: **Monocyclic:** Aromatic hydrocarbons containing one benzene ring in their molecules are called monocyclic aromatic hydrocarbons e.g. benzene, toluene, phenol, aniline benzoic acid, benzaldehyde and benzene sulphonic acid.
Polycyclic: Aromatic hydrocarbons containing two or more benzene rings in their molecules are called monocyclic aromatic hydrocarbons. These are further divided into two main classes;

(i).. Those in which benzene rings are isolated. For example biphenyl, diphenylmethan etc.

Biphenyl Diphenylmethane

(ii).. Those in which the benzene rings are fused together at ortho position so that the adjacent rings have a common carbon to carbon bonds. For example, naphthalene, phenanthrene and anthracene.
Examples:
Naphthalene, Anthracene, Phenanthrene

5. **Write down formulas for (i).. Aniline (ii) Toluene**

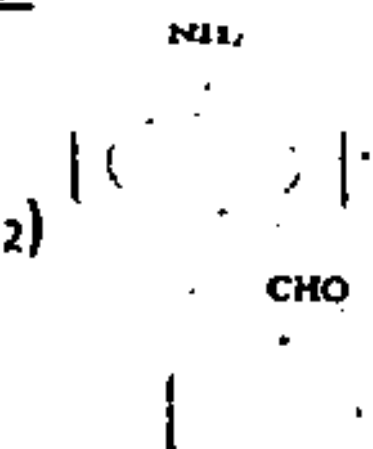
Ans: **Formulas of(i).. Aniline (ii) Toluene**

(i)..Aniline($C_6H_5NH_2$): (ii)Toluene($C_6H_5CH_3$):

6. **What is meant by the terms: (i).. Aromatic (ii).. Oxidation**

Ans: (i).. **Aromatic:** The term aromatic was derived from the Greek word 'aroma' meaning "fragrant" and was used in organic chemistry for s special class of compounds. These compounds have low hydrogen to carbon ratio in their molecular formula and have a characteristic odour. These often produced by benzene or derivatives of benzene.
(ii).. **Oxidation:** The addition of oxygen, removal of hydrogen or electrons is called oxidation. Oxidation process is carried out by some oxidizing agent like $KMnO_4$, $K_2Cr_2O_7$ or V_2O_5etc. which can provide oxygen to a compound.

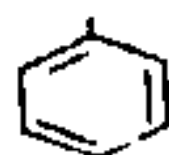
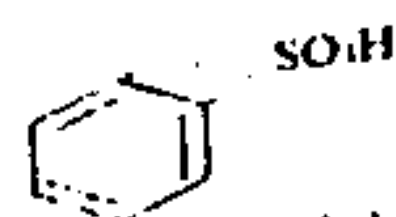
7. **Write down the formula of aniline and benzaldehyde.**

Ans: **Formulae of aniline and benzaldehyde:**

Formula of aniline :($C_6H_5NH_2$)

Formula of benzaldehyde :(C_6H_5CHO)

8. **Name the formulas of any two aromatic acids along with names.**

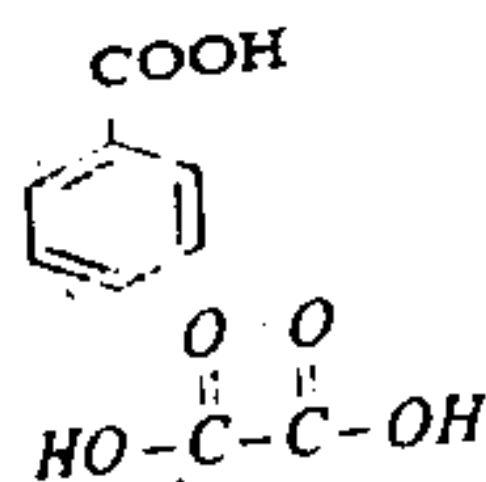
Ans: **Formulas aromatic acids:**

COOH — Benzoic acid

SO_3H — Benzene sulphonic acid

9. **Write down structural formulas of (a) oxalic acid (b) benzoic acid (2 times)**

Ans: **Structural formulae of oxalic acid and benzoic acid:**

Structural formula of benzoic acid: COOH

Structural formula of oxalic acid : $HO-\overset{O}{\overset{\|}{C}}-\overset{O}{\overset{\|}{C}}-OH$

10. **Write structural formulae of following compounds.**
(i) Benzyl alcohol (ii) phenyl hydrazine

Ans: **Structural formulae:**

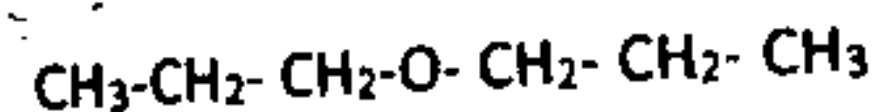
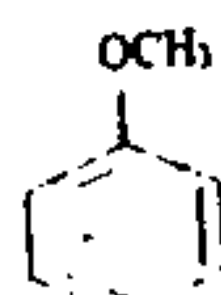
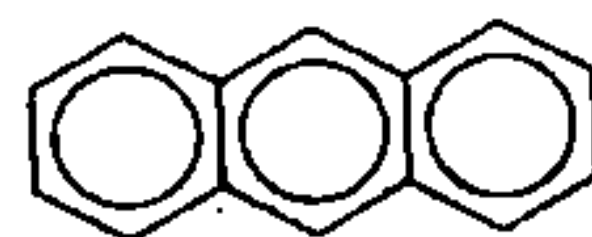
(i) Benzyl alcohol : $C_6H_5CH_2OH$

(ii) Phenyl hydrazine : $C_6H_5NH\text{-}NH_2$

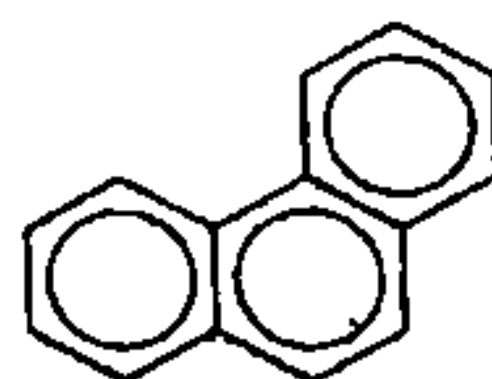
11. **Draw structure of (a) methoxy benzene (b) n-dipropyl ether**

Ans: (a) methoxy benzene

OCH_3

(b) n-dipropyl ether: $CH_3\text{-}CH_2\text{-}CH_2\text{-}O\text{-}CH_2\text{-}CH_2\text{-}CH_3$

12. **Write down structures of**
(a) Anthracene (b) Phenanthrene

Ans: (a) **Anthracene**

Anthracene

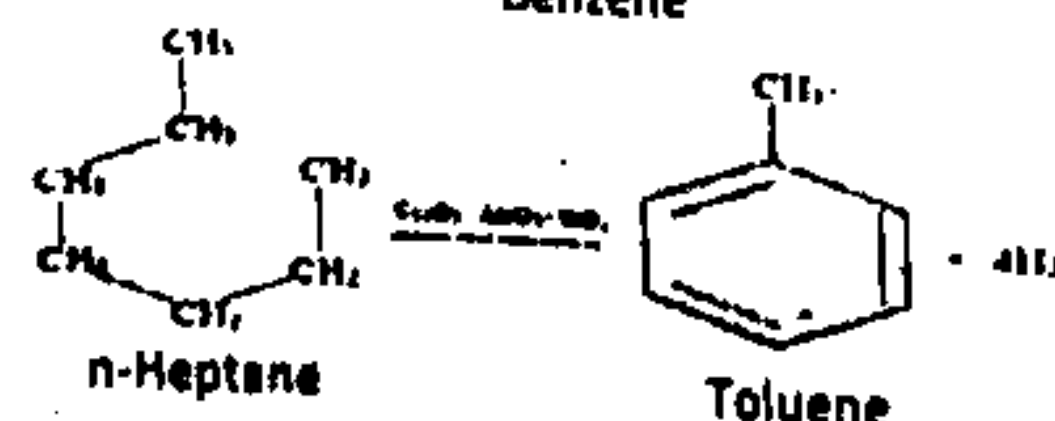
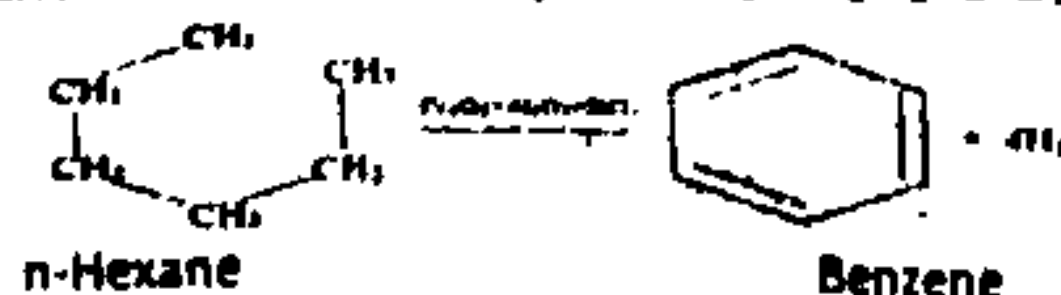
(b) **Phenanthrene**

Phenanthrene

Topic No: 9.1/3

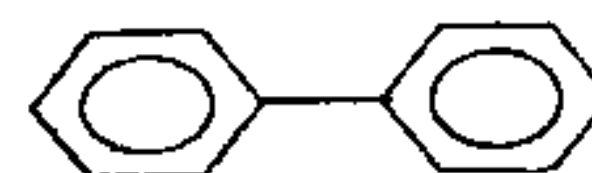
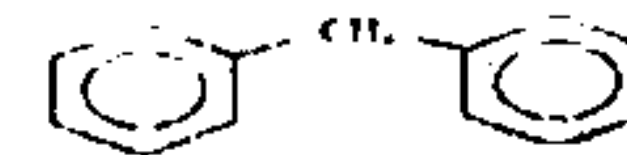
13. **How Haxane and Heptane can give Benzene and Toluene respectively?**

Ans: Benzene and toluene are prepared by passing the vapours of n-hexane or n heptane over the mixture of catalyst $Cr_2O_3+Al_2O_3+SiO_2$ at 500ºC.

n-Hexane → Benzene + $4H_2$

n-Heptane → Toluene + $4H_2$

14. **What are polycyclic aromatic hydrocarbons? Give example.**

Ans: Aromatic hydrocarbons containing two or more benzene rings in their molecules are called monocyclic aromatic hydrocarbons. These are further divided into two main classes;

(i).. Those in which benzene rings are isolated. For example biphenyl, diphenylmethan etc.

Biphenyl Diphenylmethane

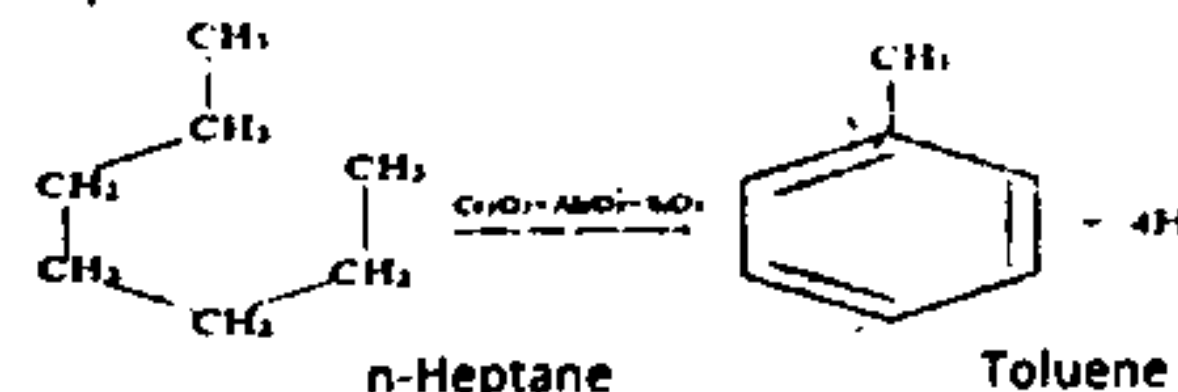
(ii).. Those in which the benzene rings are fused together at ortho position so that the adjacent rings have a common carbon to carbon bonds. For example, naphthalene, phenanthrene and anthracene.

Examples:

Naphthalene, Anthracene

and Phenanthrene

15. **Convert heptane into toluene?**

Ans: Toluene is prepared by passing the vapours of n-heptane over the mixture of catalyst $Cr_2O_3+Al_2O_3+SiO_2$ at 500ºC.

n-Heptane → Toluene + $4H_2$

16. **Write structures of the followings: (i) Naphthalene(ii)Anthracene (2 times)**

Ans: **Structures of Naphthalene and Anthracene:**

Naphthalene Anthracene

Topic No: 9.2/3

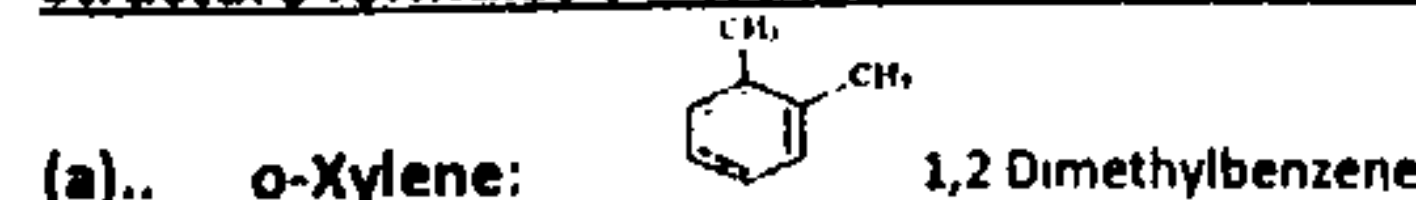
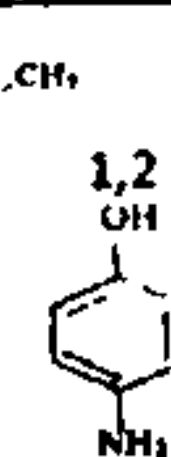
17. **Write names and draw structures of three possible isomers of Xylene?(4 times)**

Ans: **Names and structures of three possible isomers of Xylene:-**

1,2Dimethylbenzene (o-Xylene) 1,3 Dimethylbenzene (m-Xylene) 1,4 Dimethylbenzene (p-Xylene)

18. **Write down structure formulas of**
(a).. o-Xylene (b).. 4-amino phenol

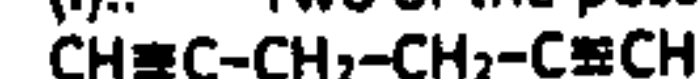
Ans: **Structure formulas of (a).. o-Xylene (b)..4-amino phenol**

(a).. **o-Xylene:** 1,2 Dimethylbenzene

(b).. **4-amino phenol:** OH, NH_2

Topic No: 9.3.2

19. **Give two reasons to rule out straight chain structure of benzene? (2 times)**

Ans: (i).. Two of the possible straight chain formulas suggested for benzene are:

$CH\equiv C-CH_2-CH_2-C\equiv CH$ (1,5-Hexadiyne)

$CH_2=CH-C\equiv C-CH=CH_2$ (1,5-Hexadiene-3-yne)

A compound having above structures are oxidized by alkaline $KMnO_4$ solution. But benzene is stable to $KMnO_4$ solution.

(ii).. Assuming straight chain structure of benzene, each carbon carries one H atom, it should be capable of forming three mono substitution products. But benzene yields only one mono substituent product.

(iii).. Alkanes have molecular formula C_nH_{2n+2}, alkene has C_nH_{2n} and alkyne has C_nH_{2n-2}. But benzene has molecular formula C_6H_6 does not belong to open chain hydrocarbon and therefore possibility of a straight chain structure is ruled out.

20. How will you prove that, benzene has cyclic structure?

Ans The X-Ray studies of benzene have confirmed the hexagonal structure of it. These studies have also revealed that all the carbon and hydrogen atoms are in the same plane. All the angles are of 120°. All C-C and C-H bonds lengths are 1.397 A° and 1.09A° respectively.

Topic No: 9.3.4

21. What informations are obtained about structure of benzene from X-ray studies. **(5 times)**

Ans: The X-Ray studies of benzene have confirmed the hexagonal structure of it. These studies have also revealed that all the carbon and hydrogen atoms are in the same plane. All the angles are of 120°. All C-C and C-H bonds lengths are 1.397 A° and 1.09A° respectively.

Topic No: 9.3.7

22. Define resonance energy? What is the resonance energy of Benzene?(6 times)

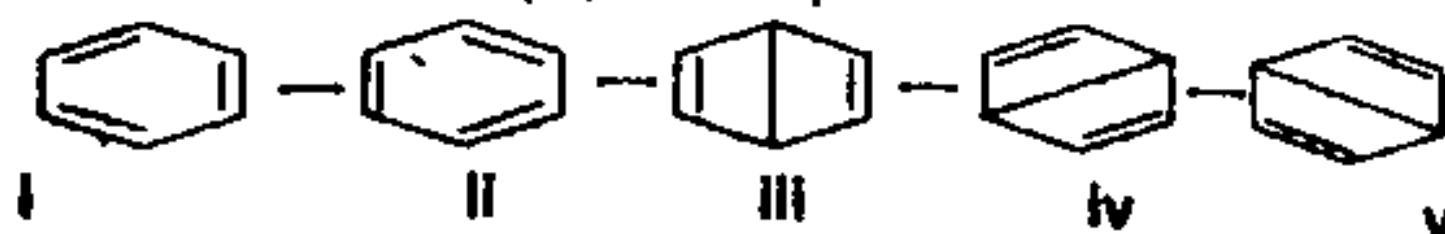
Ans: Benzene is more stable than the hypothetical 1,3,5-cyclohexatriene by 150.5 kJ/mole. This difference between amount of heat is actually released and that calculated on the basis of the Kekule structure is called 'Resonance Energy'. Benzene shows the phenomenon of resonance which makes it more stable than others. In benzene electrons are delocalized making it a very stable molecule. The resonance energy of benzene is 150.5 kJ/mole.

23. What objections were raised on Kekule's formula of Benzene? **(2 times)**

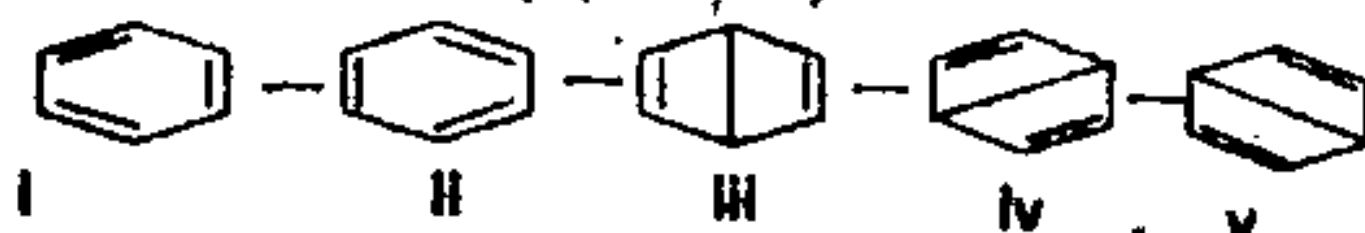
Ans: Kekule's formula with three double bonds demands a high degree of unsaturation from benzene while usually it exhibits a saturated character. This benzene yields substitution products readily and forms addition products reluctantly. Benzene is also a very stable compound, all these properties of benzene can easily explained use in their modern theories about it structure.

24. What is resonance? Draw two resonance structures of benzene. **(2 times)**

Ans: The possibility of different pairing schemes of valence electrons of atoms is called resonance, and the different structures thus arranged are called "Resonance structures". Benzene has two Kekule structures (i and ii) and three Dewar structures (iii,iv and v).

I — II — III — Iv — v

25. Write down the resonance structures of benzene?

Ans: The possibility of different pairing schemes of valence electrons of atoms is called resonance, and the different structures thus arranged are called "Resonance structures". Benzene has two Kekule structures (i and ii) and three Dewar structures (iii,iv and v).

I — II — III — Iv — v

26. Define resonance and resonance Energy.

Ans: Benzene is more stable than the hypothetical 1,3,5-cyclohexatriene by 150.5 kJ/mole. This difference between amount of heat is actually released and that calculated on the basis of the Kekule structure is called 'Resonance Energy'. Benzene shows the phenomenon of resonance which makes it more stable than others. In benzene electrons are delocalized making it a very stable molecule. The resonance energy of benzene is 150.5 kJ/mole.

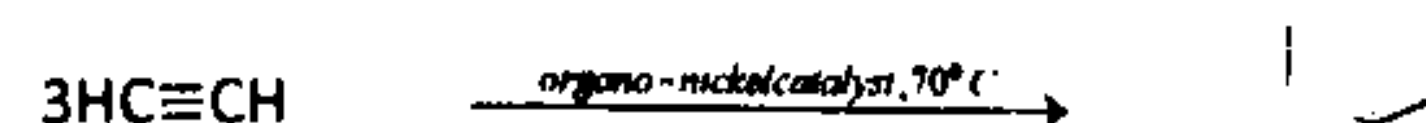
Topic No: 9.4

27. Why benzene is less reactive than alkenes although it has three pi (π) bonds in it? **(3 times)**

Ans: Benzene is extraordinary stable molecule. This stability is due to the extensive delocalization of π-electron cloud. The unhybridized2p_z orbital partially overlap to form a continuous sheath of electron cloud, enveloping, above and below, the six carbon-carbon sigma bonds of the ring. Since each 2p_z orbital is overlapped by the 2p_z orbitals of adjacent carbon atoms, therefore, this overlapping gives, diffused or delocalized electron cloud. The stability of benzene can be measured by comparing it with hypothetical compound, 1,3,5cyclohexatriene.

28. Benzene can be prepared commercially from acetylene. Give reaction with conditions? **(4 times)**

Ans: Benzene is formed by passing acetylene under pressure over an organo-nickel catalyst at 70ºC.

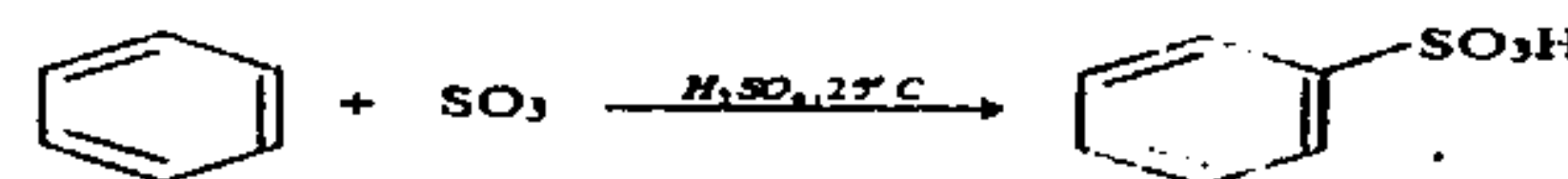
$3HC\equiv CH \xrightarrow{\text{organo-nickel catalyst, } 70^\circ C}$ (benzene)

29. Give reaction of : (a) Phenol with zinc, (b) Benzene with SO_3.

Ans: Reaction of (a) Phenol with zinc (b) Benzene withSO_3

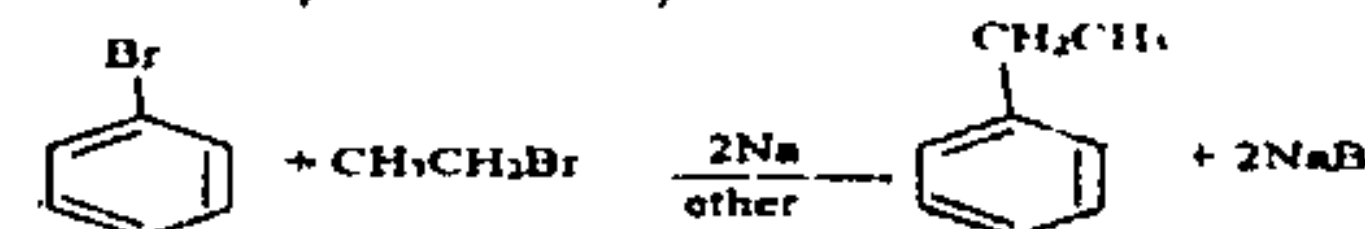
(a) Phenol with zinc:

$C_6H_5OH + Zn \xrightarrow{\Delta} C_6H_6 + ZnO$

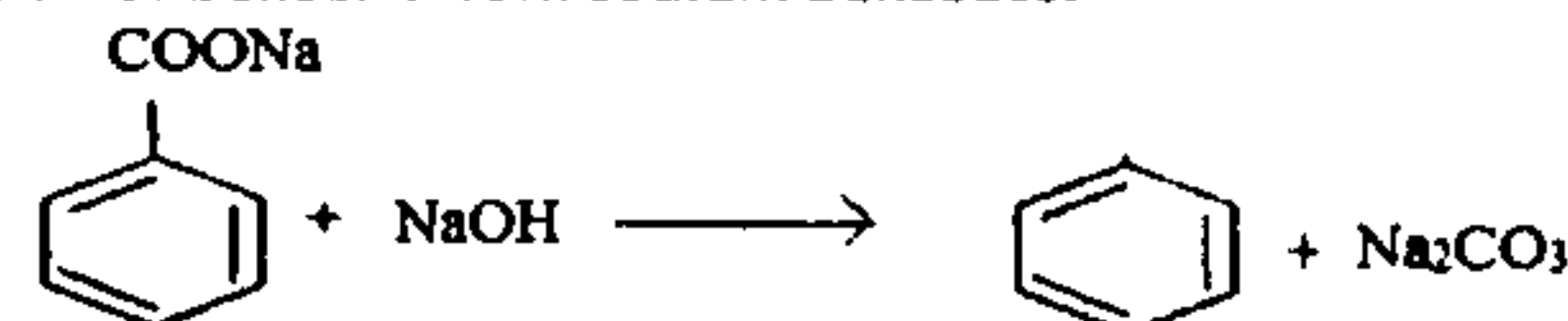
(b) Benzene with SO_3:

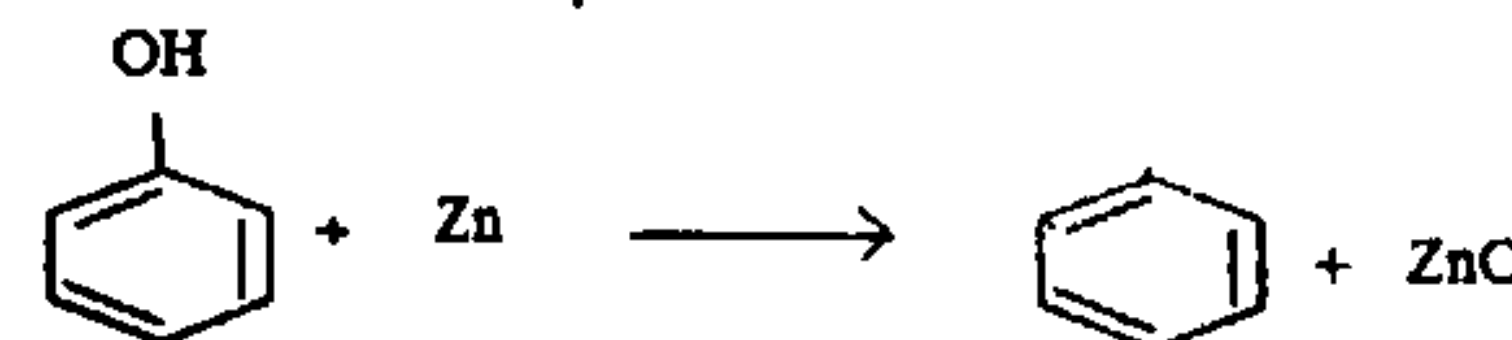
$C_6H_6 + SO_3 \xrightarrow{H_2SO_4, 25^\circ C} C_6H_5SO_3H$

30. What is Wurtz-Fritting reaction? **(4 times)**

Ans: The Wurtz reaction for the synthesis of alkanes was extended by Fitting in 1864 to the synthesis of alkyl aromatic hydrocarbons.

$C_6H_5Br + CH_3CH_2Br \xrightarrow[\text{ether}]{2Na} C_6H_5CH_2CH_3 + 2NaBr$

31. How benzene can be prepared from sodium benzoate and phenol?

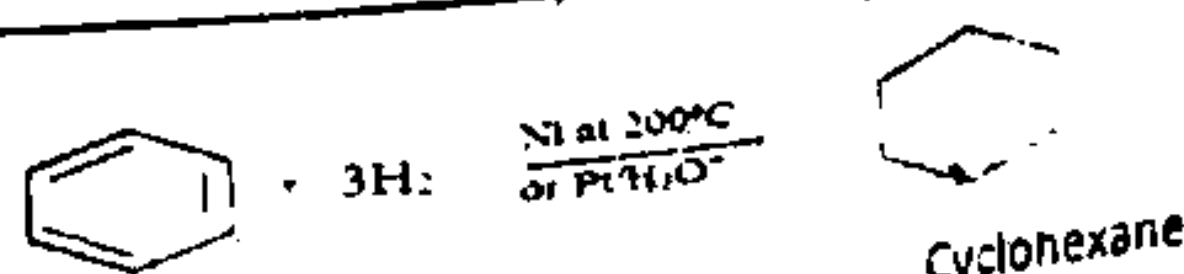
Ans **Preparation of benzene from sodium benzoate:**

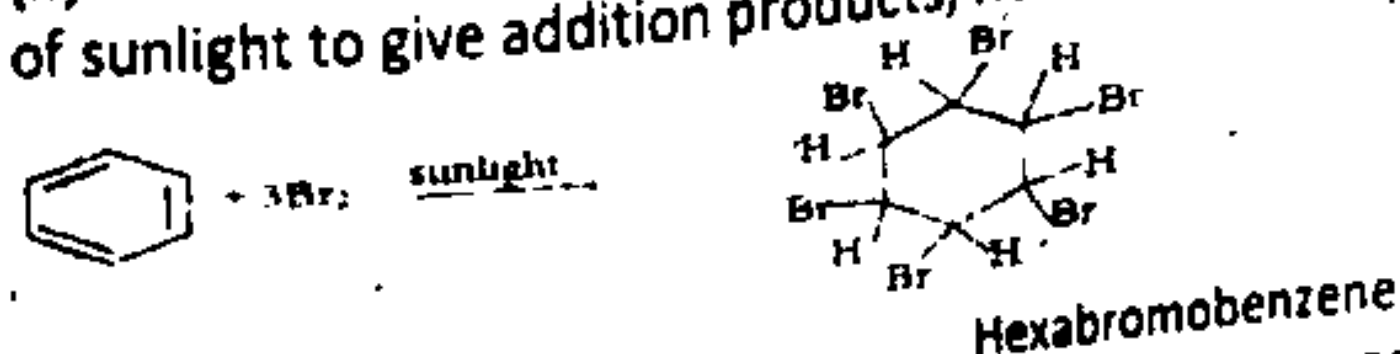
$C_6H_5COONa + NaOH \longrightarrow C_6H_6 + Na_2CO_3$

Preparation of benzene from phenol:

$C_6H_5OH + Zn \longrightarrow C_6H_6 + ZnO$

Topic No: 9.5.1

32. Give two reactions which show that Benzene is an unsaturated hydrocarbon? **(3 times)**

Ans: (I).. **Reduction:** Benzene is reduced to cyclohexane on heating at high temperature with hydrogen in the presence of Pt in an acidic solvent(acetic acid) or Ni at 200ºC as a catalyst. This reaction shows that benzene is un-saturated compound.

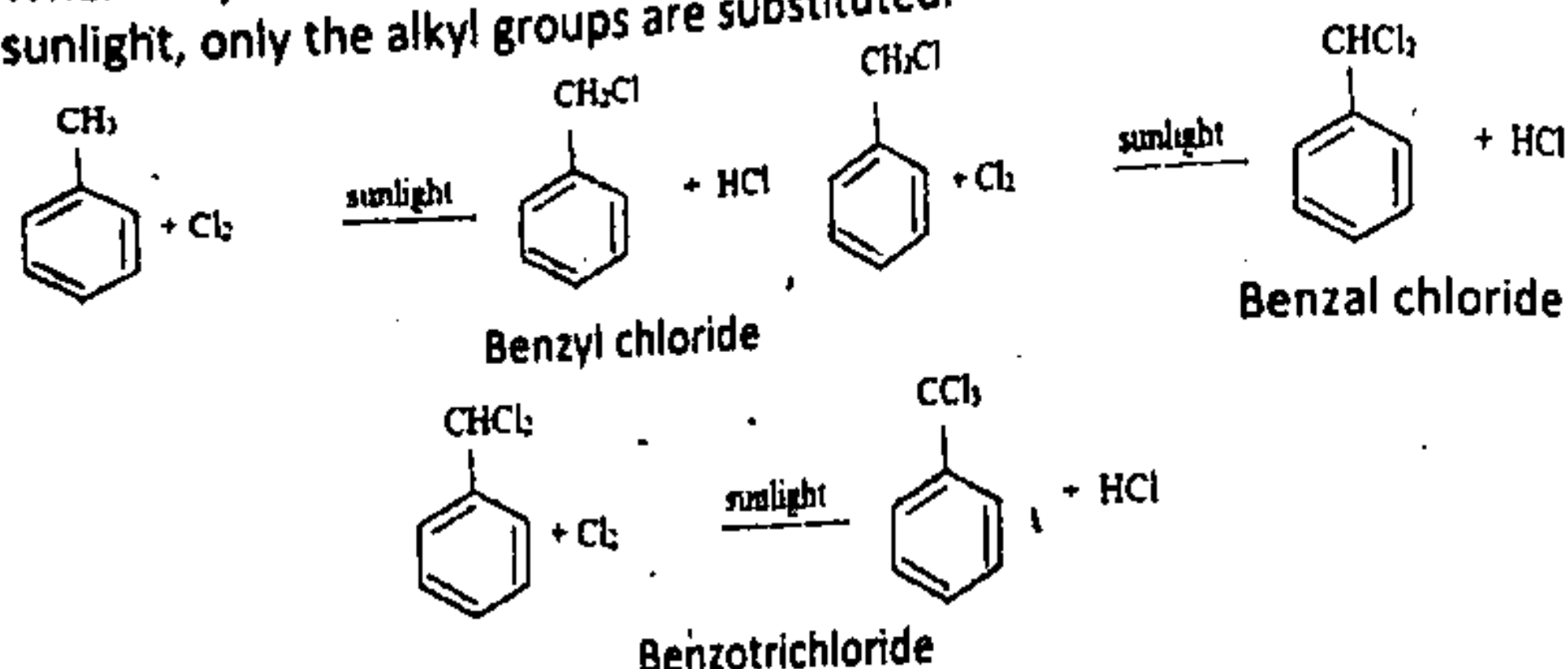
Benzene + $3H_2$ $\xrightarrow{Ni\ at\ 200°C\ or\ Pt/H_2O}$ Cyclohexane

(ii).. Halogenation: Benzene reacts with chlorine and bromine in the presence of sunlight to give addition products, hexachlorobenzene or hexabromobenzene.

Benzene + $3Br_2$ $\xrightarrow{sunlight}$ Hexabromobenzene

33. What are the major products when chlorine reacts with Toluene in the presence of sunlight?

Ans: When alkyl benzene are treated with chlorine or bromine in the presence of sunlight, only the alkyl groups are substituted.

$C_6H_5CH_3 + Cl_2 \xrightarrow{sunlight} C_6H_5CH_2Cl$ (Benzyl chloride) + HCl

$C_6H_5CH_2Cl + Cl_2 \xrightarrow{sunlight} C_6H_5CHCl_2$ (Benzal chloride) + HCl

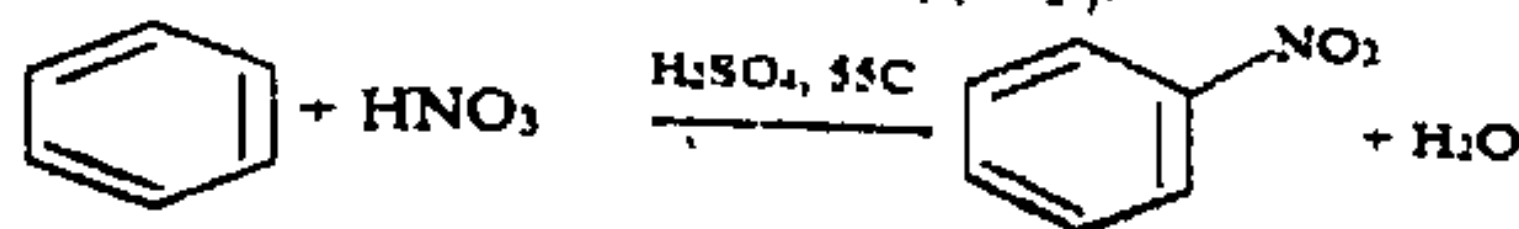
$C_6H_5CHCl_2 + Cl_2 \xrightarrow{sunlight} C_6H_5CCl_3$ (Benzotrichloride) + HCl

34. What is general pattern of reactivity of benzene towards electrophone?

Ans The highly sable, delocalized electrons of benzene ring not readily available for the nucleophilic attack like the electrons of alkenes. Therefore, the electrons of benzne ring do not assist in the attack of weak electrophiles.
It means that more powerful electrophiles are required to penetrate and break the continuous sheath of electron cloud in benzene, e.g. substitution of halogen in benzene require iron or corresponding ferric halide as a catalyst.

Topic No: 9.5.2/2

35. Write down nitration and sulphonation of Benzene?

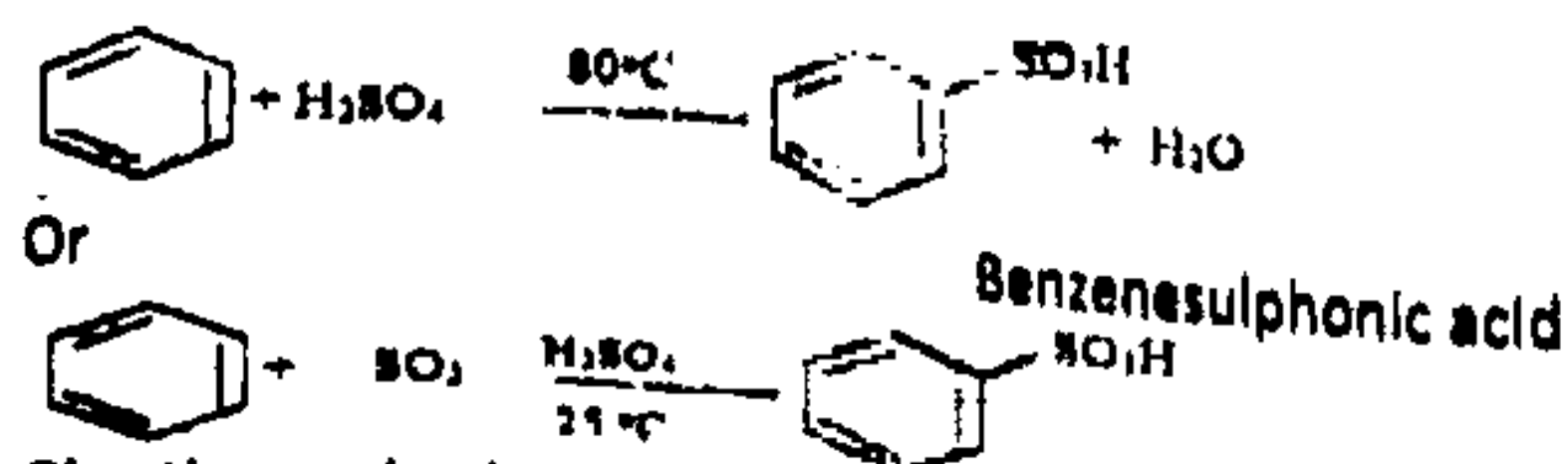
Ans: **Nitration:** The introduction of NO_2 group in benzene ring is called "Nitration". The nitration of benzene takes place when it is heated with a 1:1 mixture of conc. HNO_3 and conc. H_2SO_4 at 50-55ºC. Sulphuric acid reacts with nitric acid to generate nitronium ion, (NO_2^+).

$C_6H_6 + HNO_3 \xrightarrow{H_2SO_4,\ 55C} C_6H_5NO_2 + H_2O$

Sulphonation: The introduction of sulphonic acid group in benzene ring is called "Sulphonation". When benzene is heated with fuming H_2SO_4 or conc. H_2SO_4 it yields benzene sulphonic acid.

$C_6H_6 + H_2SO_4 \xrightarrow{80°C} C_6H_5SO_3H + H_2O$

Or

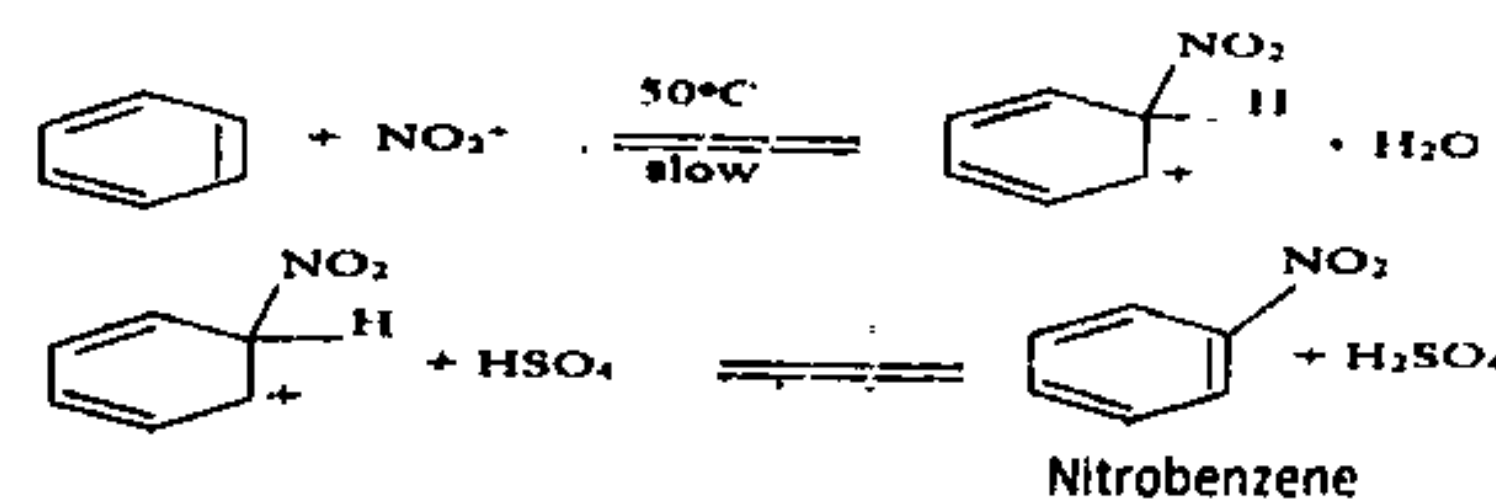
$C_6H_6 + SO_3 \xrightarrow{H_2SO_4,\ 25°C} C_6H_5SO_3H$

Benzenesulphonic acid

36. Give the mechanism of nitration of Benzene? (7 times)

Ans: **Mechanism of nitration of Benzene:**

$HONO_2 + H_2SO_4 \rightleftharpoons NO_2^+ + HSO_4^- + H_2O$

$C_6H_6 + NO_2^+ \xrightarrow[slow]{50°C} [C_6H_6NO_2]^+ + H_2O$

$[C_6H_6NO_2]^+ + HSO_4^- \rightleftharpoons C_6H_5NO_2 + H_2SO_4$

Nitrobenzene

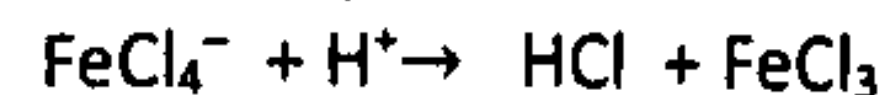
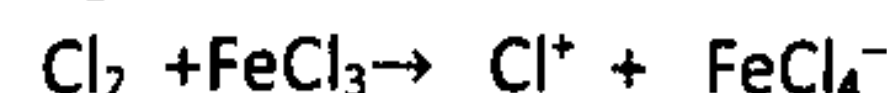
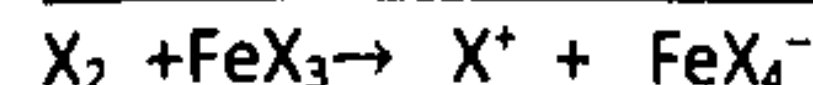
37. Write down mechanism for halogenation of benzene? (2 times)

Ans: **Mechanism for halogenation of benzene:**

$X_2 + FeX_3 \rightarrow X^+ + FeX_4^-$

$Cl_2 + FeCl_3 \rightarrow Cl^+ + FeCl_4^-$

$C_6H_6 + Cl^+ \rightarrow [C_6H_6Cl]^+ \rightarrow C_6H_5Cl + H^+$

$FeCl_4^- + H^+ \rightarrow HCl + FeCl_3$

38. How will you prepare the following compound from benzene in two steps? (3 times)

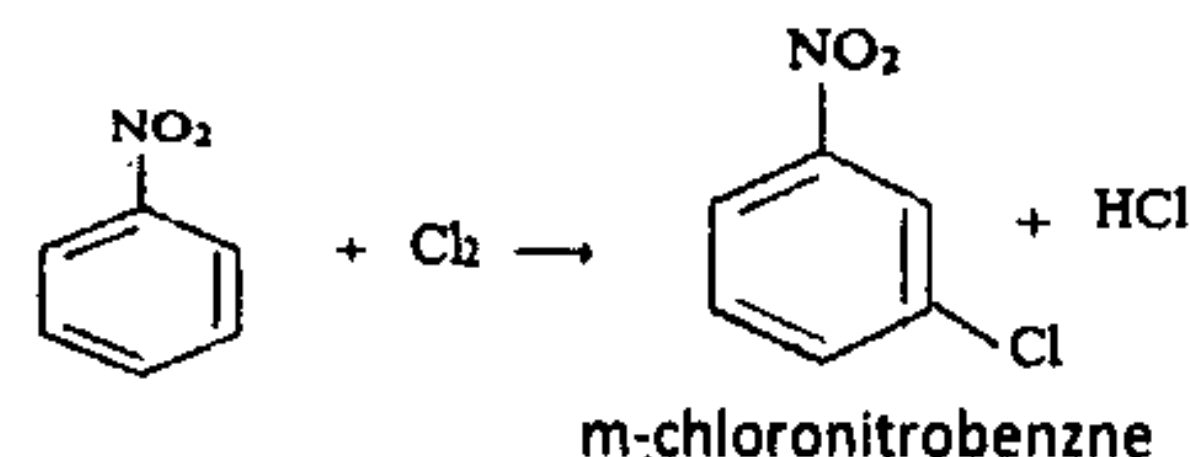
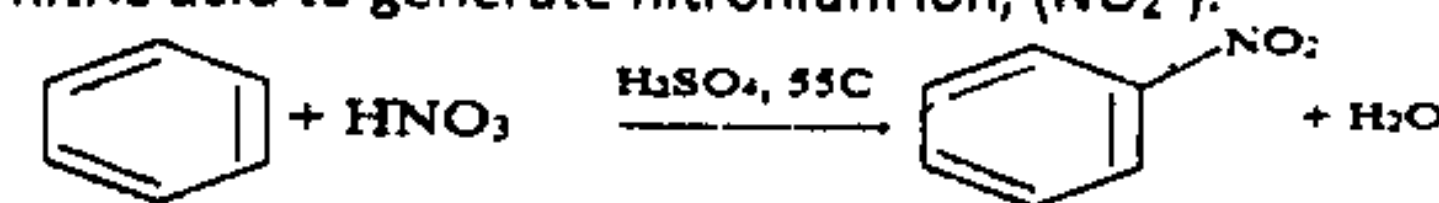
m-chloronitro benzene.

Ans: **Preparation of m-chloronitrobenzne:**

Nitration: The introduction of NO_2 group in benzene ring is called "Nitration". The nitration of benzene takes place when it is heated with a 1:1 mixture of conc. HNO_3 and conc. H_2SO_4 at 50-55ºC. Sulphuric acid reacts with nitric acid to generate nitronium ion, (NO_2^+).

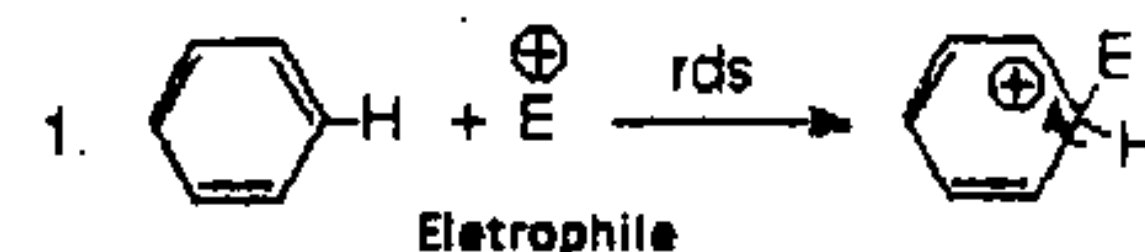
$C_6H_6 + HNO_3 \xrightarrow{H_2SO_4,\ 55C} C_6H_5NO_2 + H_2O$

$C_6H_5NO_2 + Cl_2 \rightarrow m\text{-}ClC_6H_4NO_2 + HCl$

m-chloronitrobenzne

39. Give general mechanism of electrophilic substitution reaction of benzene.

Ans: The general mechanism is as follows:

1. $C_6H_6 + E^+$ (Eletrophile) $\xrightarrow{rds}$ $[C_6H_6E]^+$

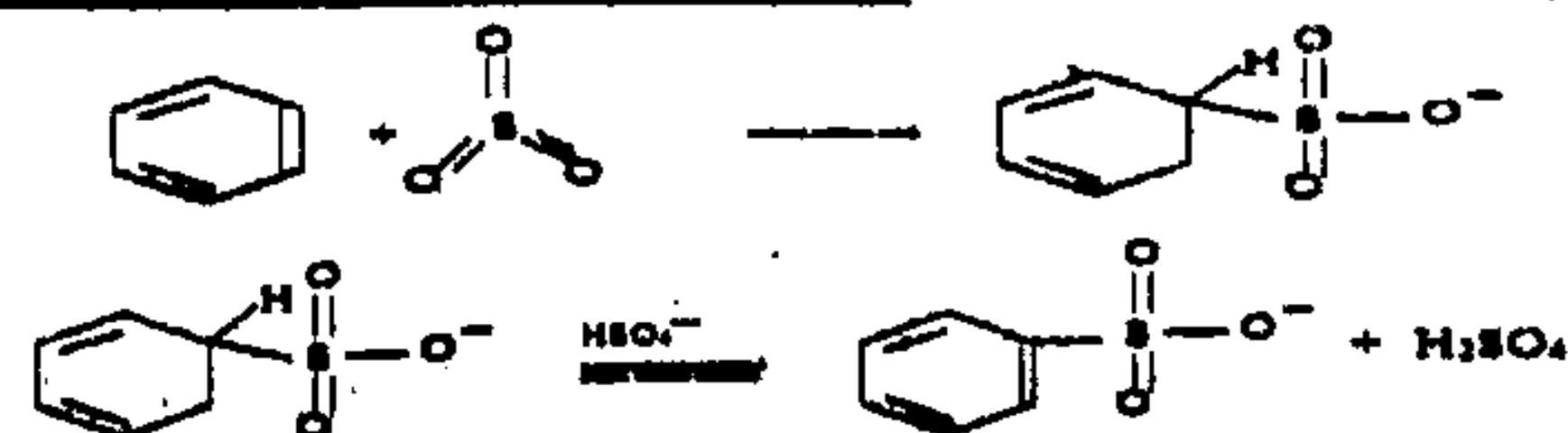
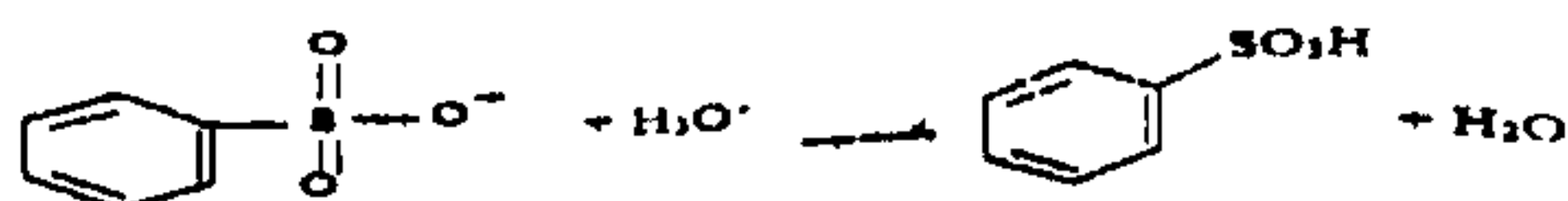
2. $[C_6H_6E]^+ + :B$ (Base) $\rightarrow C_6H_5E + BH^+$

Topic No: 9.5.2/3

40. Give mechanism of sulphonation of benzene? (3 times)

Ans: **Mechanism of sulphonation of benzene:-**

$C_6H_6 + SO_3 \rightarrow [C_6H_6SO_3^-]^+$

$[C_6H_6SO_3^-]^+ \xrightarrow{HSO_4^-} C_6H_5SO_3^- + H_2SO_4$

$C_6H_5SO_3^- + H_3O^+ \longrightarrow C_6H_5SO_3H + H_2O$

41. Convert benzene into (i) Toluene (ii) Acetophenone (3 times)

Ans: **(i).. Toluene:** Benzene is converted into toluene by Friedal Craft Alkylation process as:

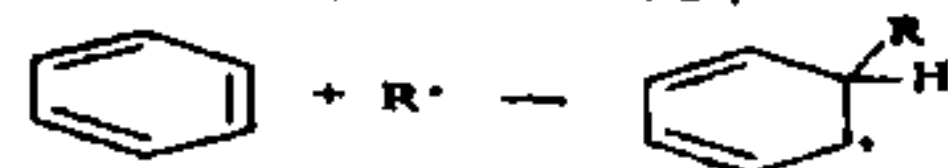
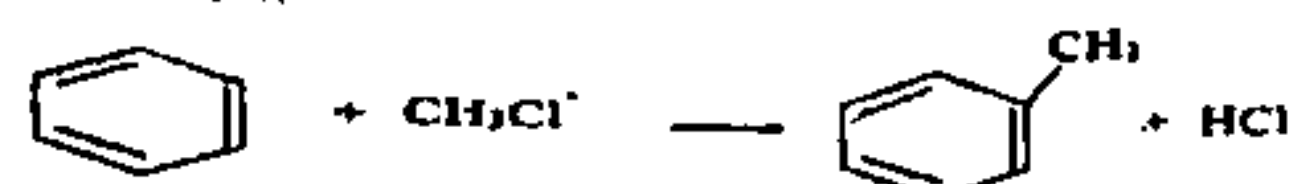
General mechanism:

$R-Cl + AlCl_3 \longrightarrow AlCl_4^- + R^+$

$C_6H_6 + R^+ \longrightarrow C_6H_6R^+$ (arenium ion)

$C_6H_6R^+ + AlCl_4^- \longrightarrow C_6H_5R + HCl + AlCl_3$

Reaction:

$C_6H_6 + CH_3Cl \longrightarrow C_6H_5CH_3 + HCl$

(ii)Acetophenone: Benzene is converted into acetophenone by Friedal Craft acylation process as:

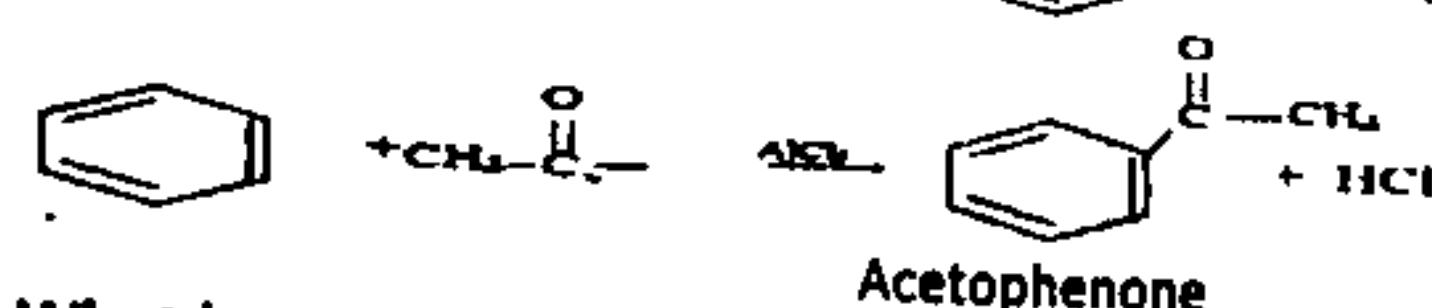
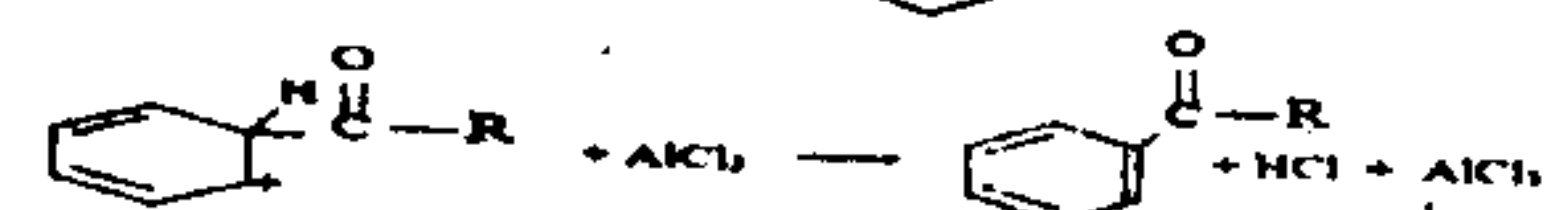
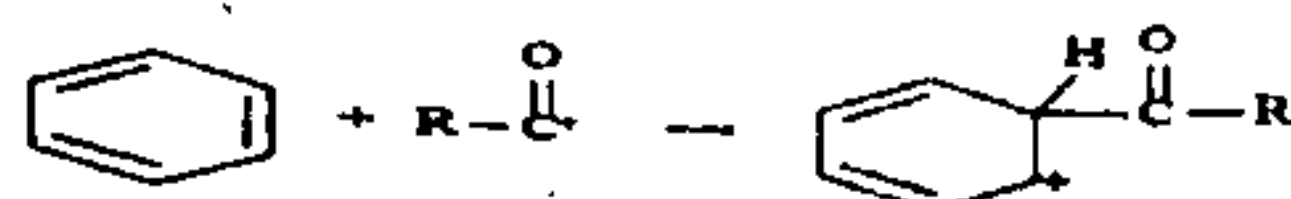
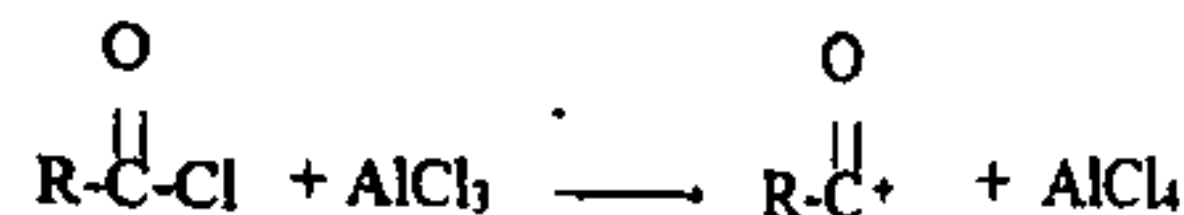
General mechanism:

$R-CO-Cl + AlCl_3 \longrightarrow R-C^+{=}O + AlCl_4$

$C_6H_6 + R-C^+{=}O \longrightarrow C_6H_6(COR)^+$

$C_6H_6(COR)^+ + AlCl_4 \longrightarrow C_6H_5COR + HCl + AlCl_3$

$C_6H_6 + CH_3-CO- \xrightarrow{AlCl_3} C_6H_5COCH_3 + HCl$

Acetophenone

42. What happens when

(a) Benzene is heated with conc. H_2SO_4 at 250°C.

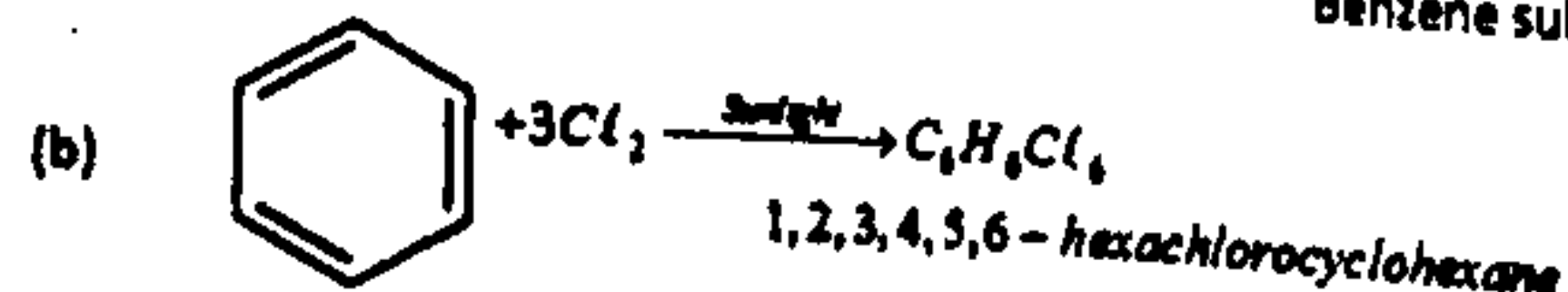
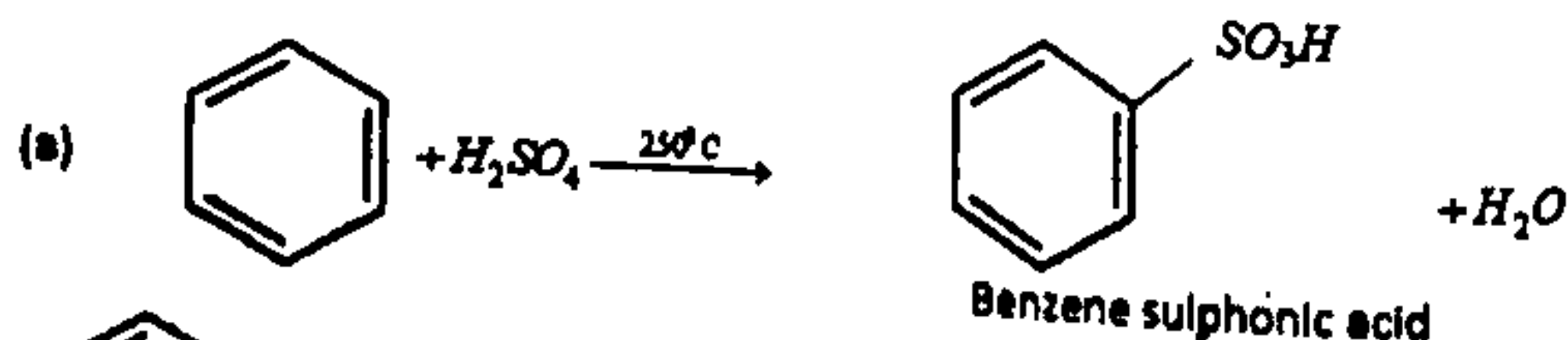
(b) Chlorine is passed through benzene in sunlight.

Ans:

(a) $C_6H_6 + H_2SO_4 \xrightarrow{250^\circ C} C_6H_5SO_3H + H_2O$

Benzene sulphonic acid

(b) $C_6H_6 + 3Cl_2 \xrightarrow{Sunlight} C_6H_6Cl_6$

1,2,3,4,5,6 – hexachlorocyclohexane

Topic No: 9.5.2/4

43. What does happen to benzene during Friedel Craft reaction.Give mechanism of one reaction? (2 times)

Ans: **Friedel Craft reaction:-**

In Fridel Craft reactions, alkylation and acylation of benzene is carried out.

Mechanism of Alkylation:

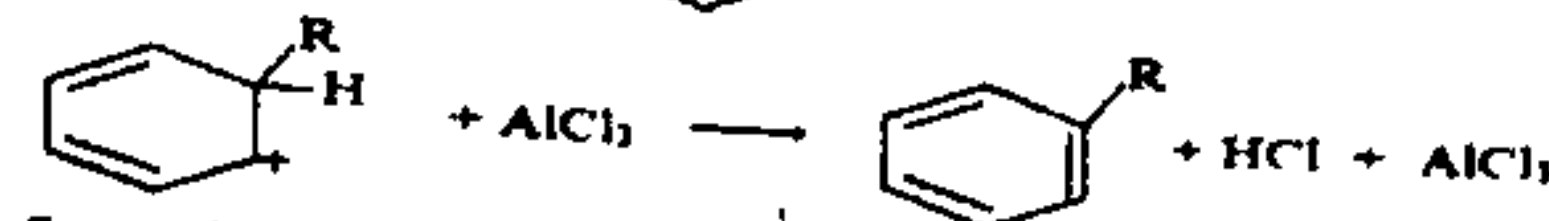
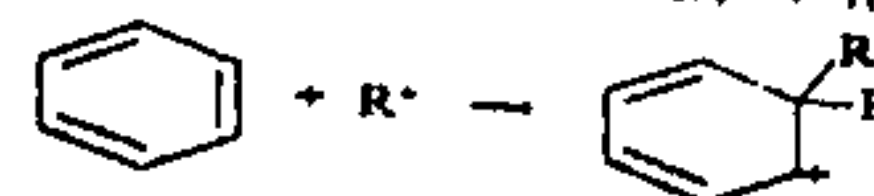
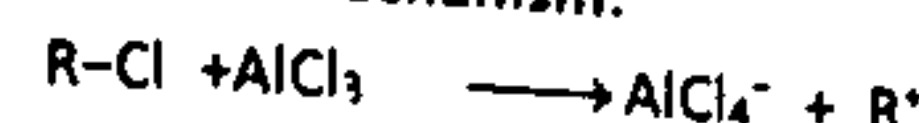
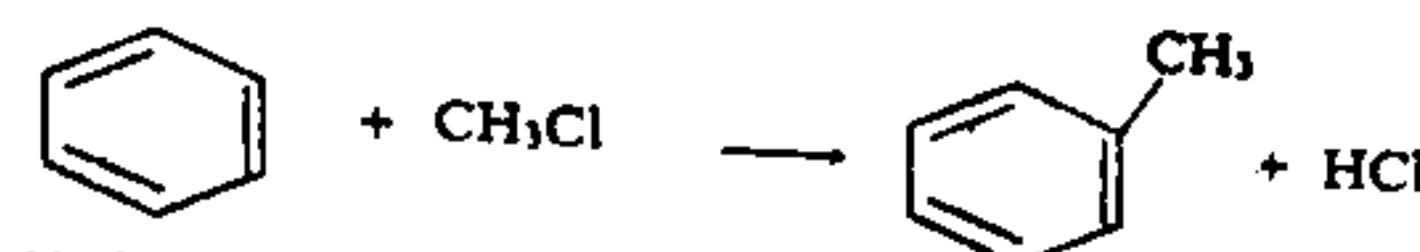
General mechanism:

$R-Cl + AlCl_3 \longrightarrow AlCl_4^- + R^+$

$C_6H_6 + R^+ \longrightarrow C_6H_6R^+$

$C_6H_6R^+ + AlCl_4^- \longrightarrow C_6H_5R + HCl + AlCl_3$

Example:

$C_6H_6 + CH_3Cl \longrightarrow C_6H_5CH_3 + HCl$

44. Write the mechanism of alkylation of benzene? (3 times)

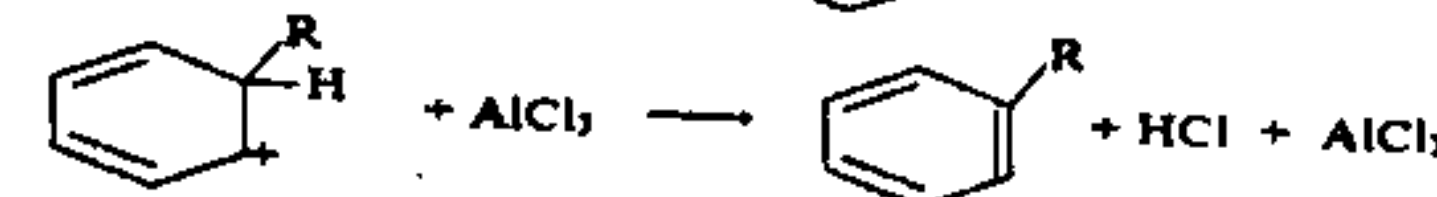
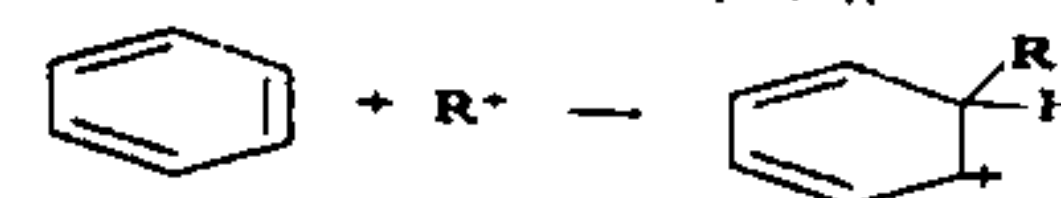
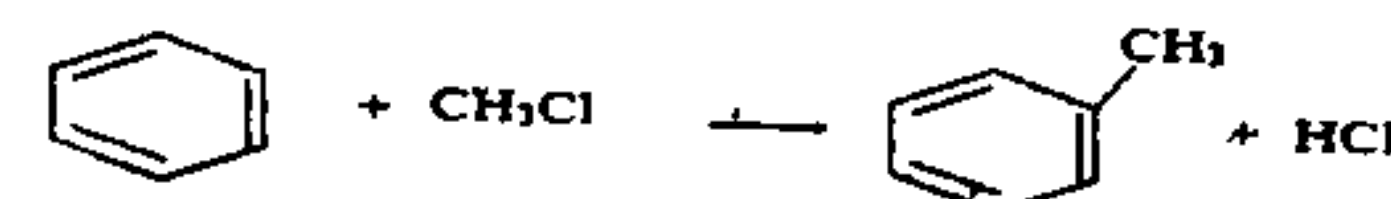
Ans: **Mechanism of alkylation of benzene:-**

$R-Cl + AlCl_3 \longrightarrow AlCl_4^- + R^+$

$C_6H_6 + R^+ \longrightarrow C_6H_6R^+$

$C_6H_6R^+ + AlCl_4^- \longrightarrow C_6H_5R + HCl + AlCl_3$

Example:

$C_6H_6 + CH_3Cl \longrightarrow C_6H_5CH_3 + HCl$

45. How Benzene can be converted to Acetophenone, give its mechanism?(4 times)

Ans: Benzene is converted into acetophenone by Friedal Craft acylation process as:

General mechanism:

$R-CO-Cl + AlCl_3 \longrightarrow R-C^+{=}O + AlCl_4$

$C_6H_6 + R-C^+{=}O \longrightarrow C_6H_6(COR)^+$

$C_6H_6(COR)^+ + AlCl_4 \longrightarrow C_6H_5COR + HCl + AlCl_3$

Reaction:

$C_6H_6 + CH_3-CO- \xrightarrow{AlCl_3} C_6H_5COCH_3 + HCl$

Acetophenone

46. How will you prepare 2, 4, 6 – trinitrotoluene from benzene in two steps

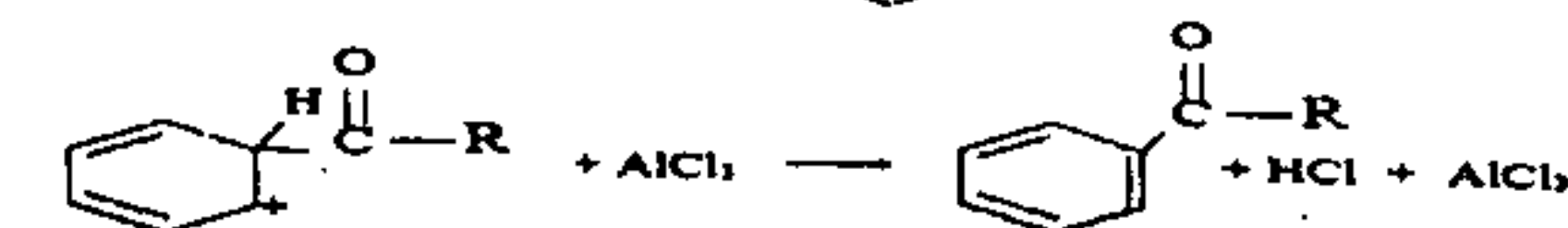
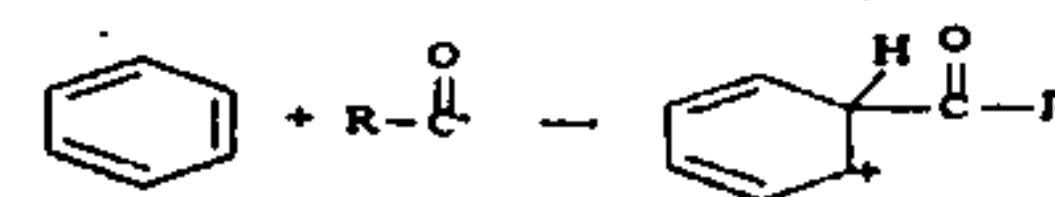
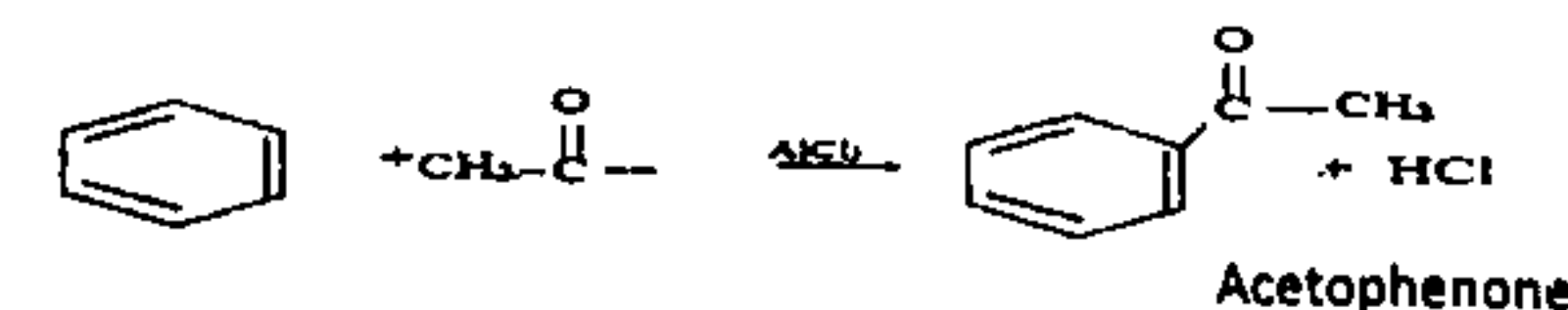
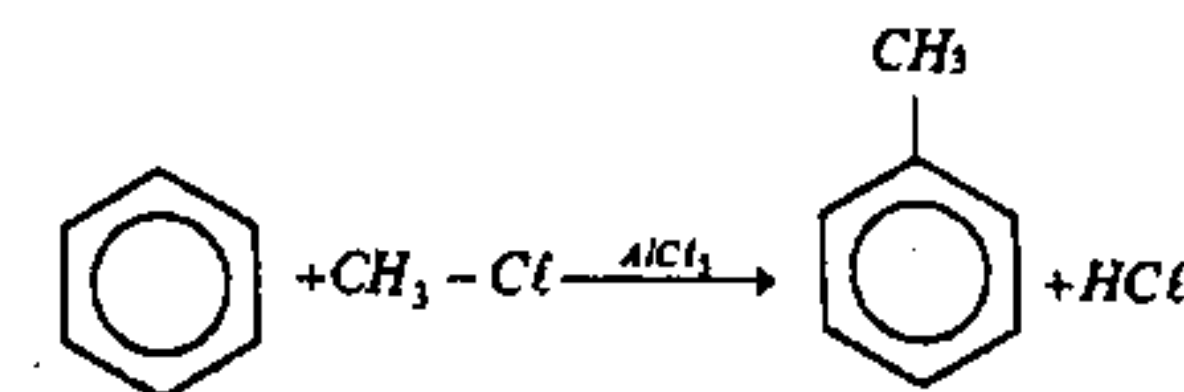
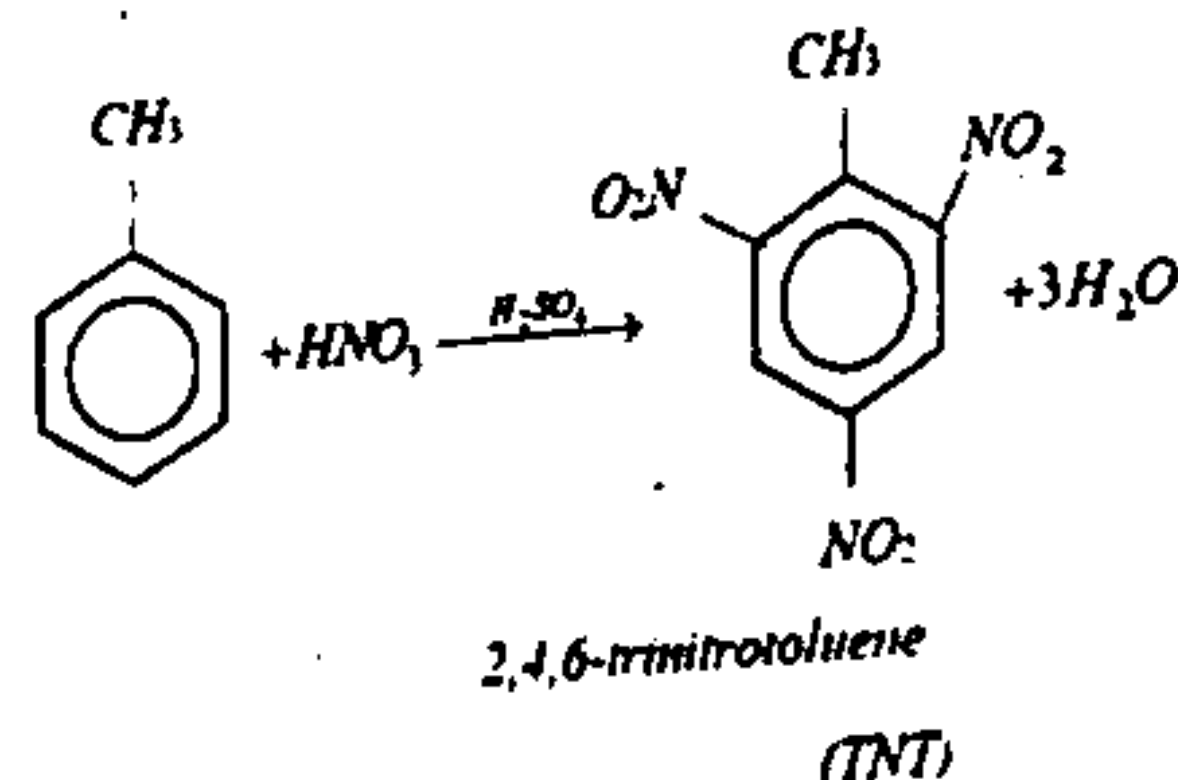
Ans: (i)

$C_6H_6 + CH_3-Cl \xrightarrow{AlCl_3} C_6H_5CH_3 + HCl$

(ii)

$$C_6H_5CH_3 + HNO_3 \xrightarrow{H_2SO_4} C_6H_2(CH_3)(NO_2)_3 + 3H_2O$$

2,4,6-trinitrotoluene

(TNT)

Topic No: 9.5.3

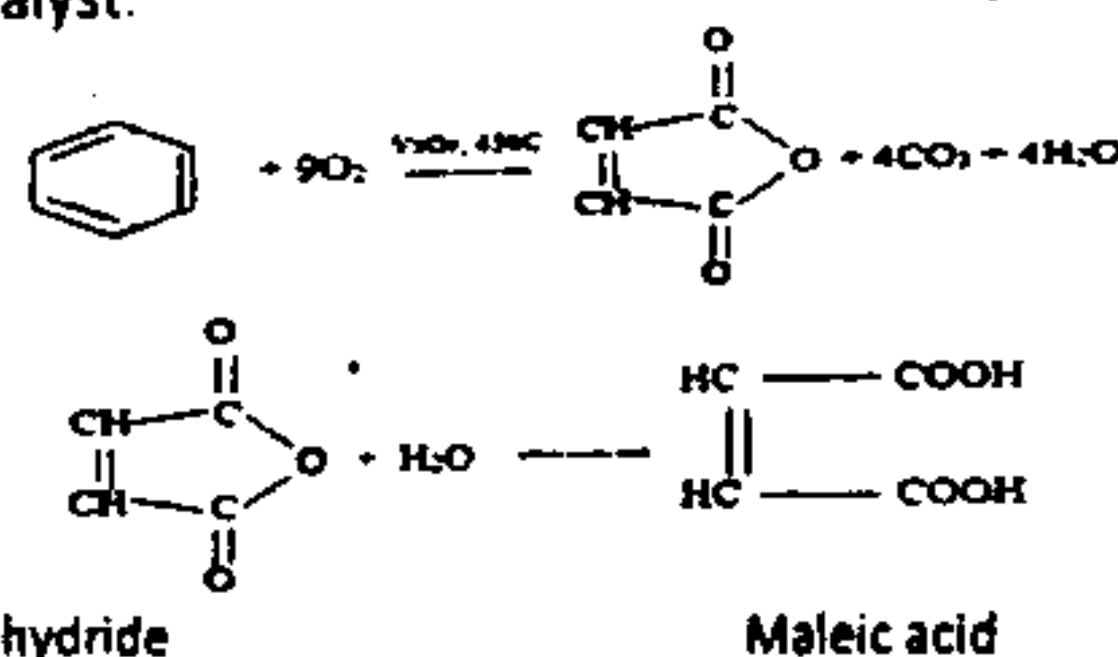
47. Convert Benzene to maleic acid?

Ans: **Conversion of Benzene to maleic acid:-**

The benzene ring is destroyed when it is strongly heated with air in the prese[nce] of V_2O_5 as a catalyst.

$$C_6H_6 + 9O_2 \xrightarrow{V_2O_5,\ 450C} \text{Maleic anhydride} + 4CO_2 + 4H_2O$$

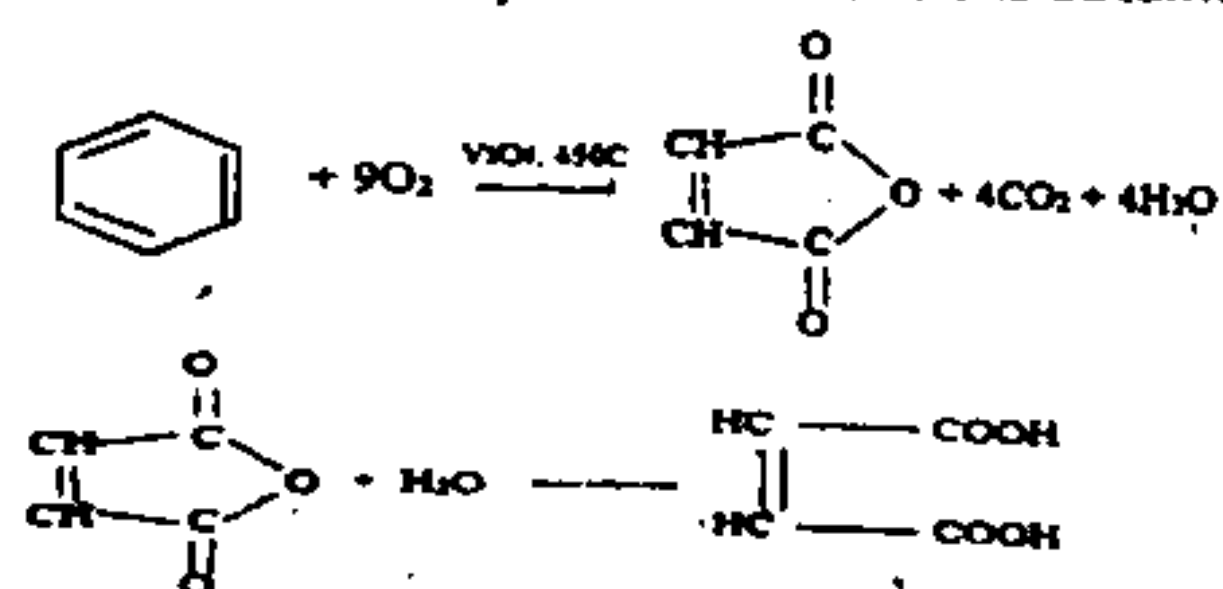
$$\text{Maleic anhydride} + H_2O \longrightarrow \text{Maleic acid (HC–COOH = HC–COOH)}$$

Maleic anhydride Maleic acid

48. Write the reaction when mixture of benzene vapours and oxygen is passed over heated vanadium pentoxide? (5 times)

Ans: The benzene ring is destroyed when it is strongly heated with air in the prese[nce] of V_2O_5 as a catalyst and maleic acid is obtained.

$$C_6H_6 + 9O_2 \xrightarrow{V_2O_5,\ 450C} \text{Maleic anhydride} + 4CO_2 + 4H_2O$$

$$\text{Maleic anhydride} + H_2O \longrightarrow \text{Maleic acid}$$

Maleic anhydride Maleic acid

49. How toluene can be converted to benzoic acid? (3 times)

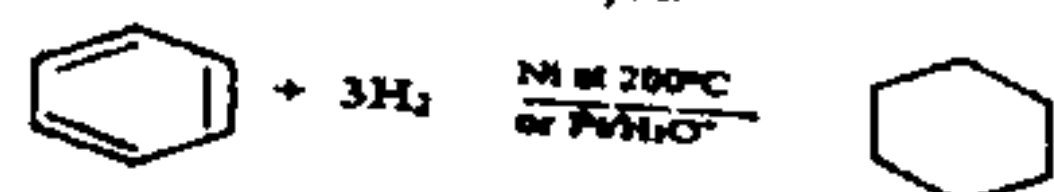
Ans: Alkyl benzene are readily oxidized by acidified $KMnO_4$ or $K_2Cr_2O_7$. In the reactions, the alkyl groups are oxidized keeping the benzene ring intact.

Benzoic acid

50. Write two addition reactions of benzene.

Ans: (1). Reduction: Benzene is reduced to cyclohexane on heating at hi[gh] temperature which hydrogen in the presence of Pt in an acidic solvent (acetic a[cid]) or Ni at 200°C as a catalyst.

$$C_6H_6 + 3H_2 \xrightarrow[\text{or Pt/}H_3O^+]{\text{Ni at }200^\circ C} C_6H_{12}$$

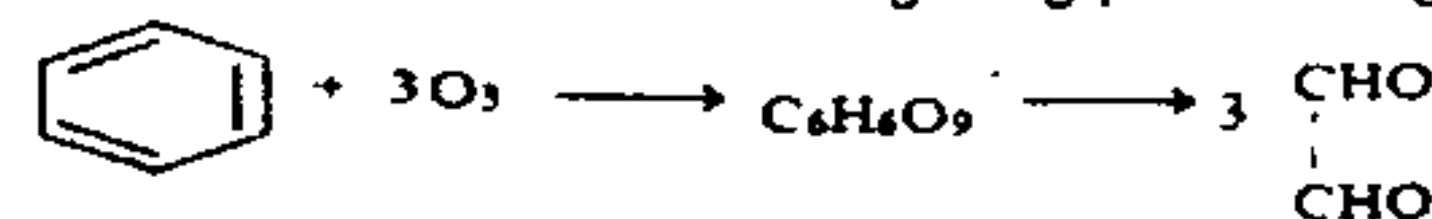
Benzene Cyclohexane

(2). Combustion: When benzene is burnt in free supply of air, it is comple[tely] oxidized to CO_2 and H_2O.

$$2C_6H_6 + 15O_2 \rightarrow 12CO_2 + 6H_2O$$

51. What happen when ozone is reacted with benzene? (3 times)

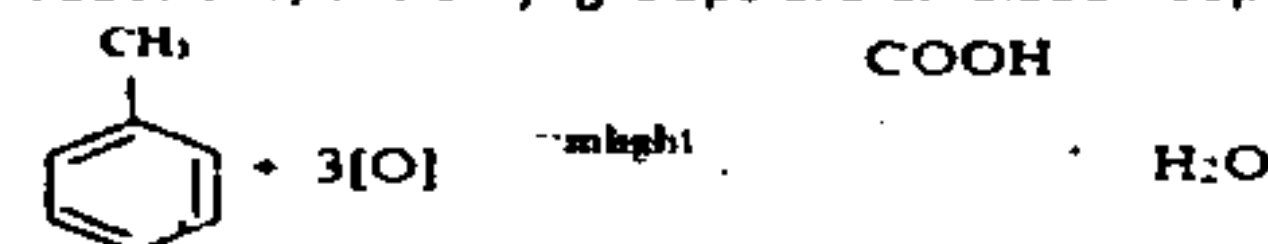
Ans: Benzene react with ozone and gives glyoxal through benzene triozonide.

$$C_6H_6 + 3O_3 \longrightarrow C_6H_6O_9 \longrightarrow 3\ \text{CHO–CHO}$$

Benzene triozonideGlyoxal

52. How Toluene can be converted to benzoic acid?

Ans: Alkyl benzenes re readily oxidized by acidified $KMnO_4$ or $K_2Cr_2O_7$. In these reactions, the alkyl groups are oxidized keeping the benzene ring intact.

$$C_6H_5CH_3 + 3[O] \xrightarrow{\text{sunlight}} C_6H_5COOH + H_2O$$

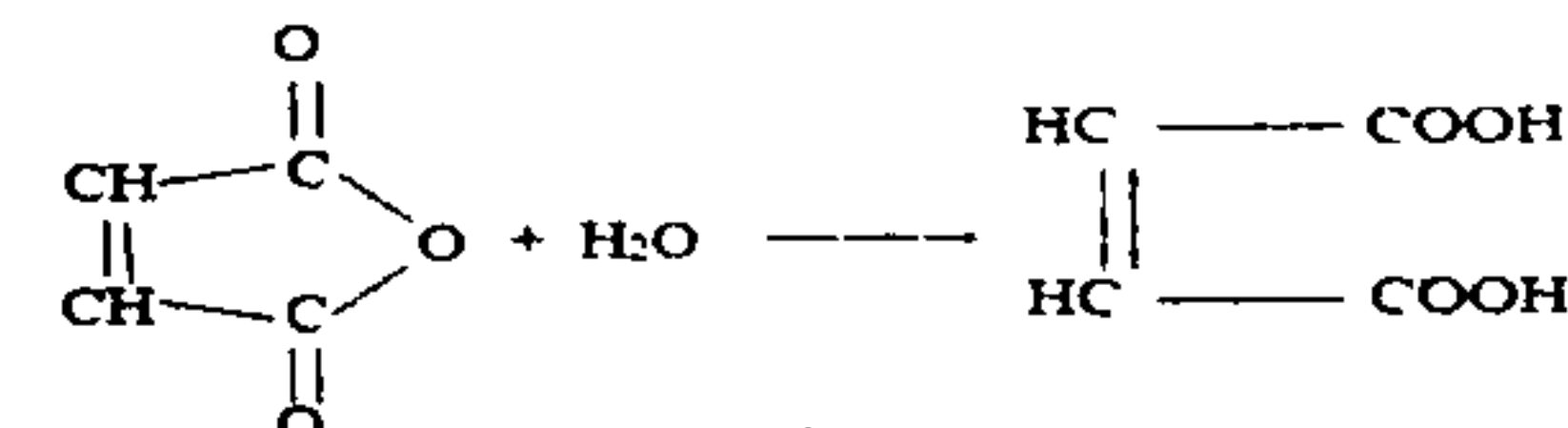
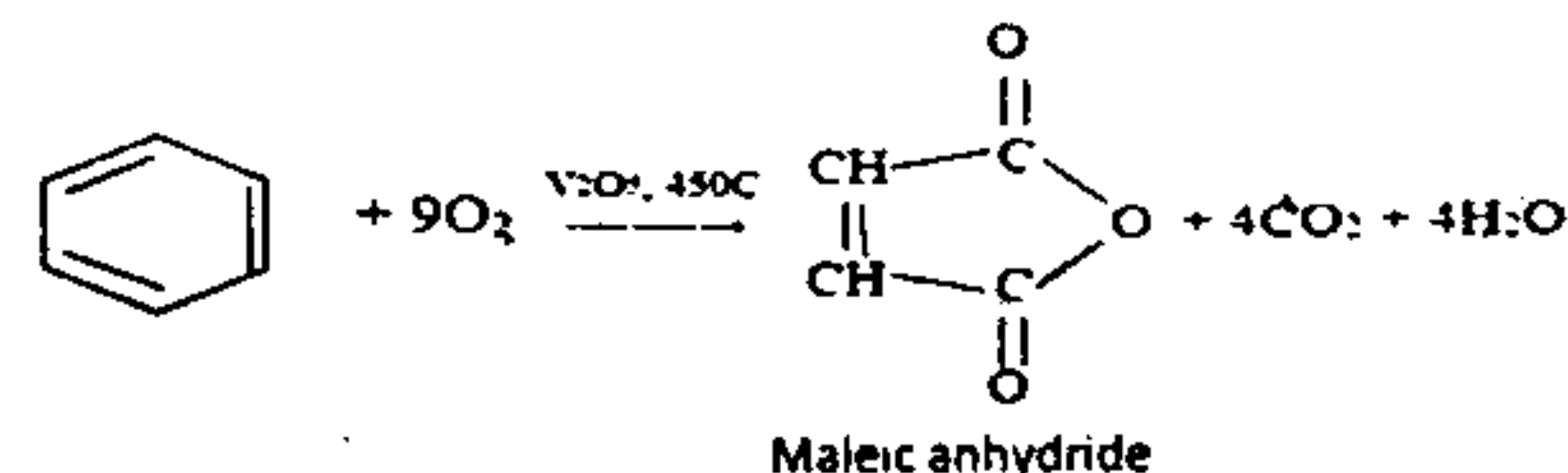
Toluene Benzoic acid

53. How benzene is converted into maleic acid by catalytic oxidation? (2 times)

Ans: Benzene ring is destroyed when it is strongly heated with air in the presence of V_2O_5 as a catalyst and maleic acid is obtained.

$$C_6H_6 + 9O_2 \xrightarrow{V_2O_5,\ 450C} \text{Maleic anhydride} + 4CO_2 + 4H_2O$$

Maleic anhydride

$$\text{Maleic anhydride} + H_2O \longrightarrow \text{HC–COOH} \,\|\, \text{HC–COOH}$$

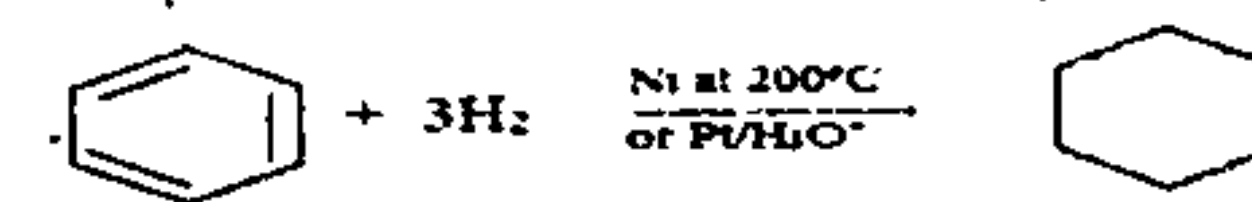
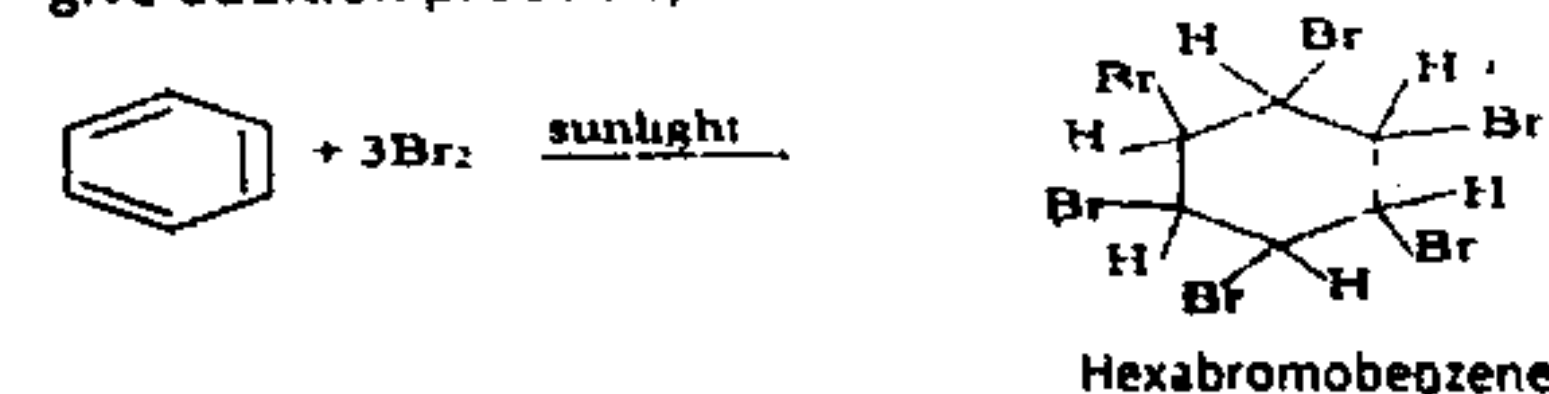
Maleic anhydride Maleic acid

54. Give two reactions which confirm presence of three double bonds in benzene ring.

Ans (i) Benzene is reduced to cyclohexane on heating at high temperature which hydrogen in the presence of Pt in an acidic solvent (acetic acid) or Ni at 200°C as a catalyst.

$$C_6H_6 + 3H_2 \xrightarrow[\text{or Pt/}H_3O^+]{\text{Ni at }200^\circ C} C_6H_{12}$$

Benzene Cyclohexane

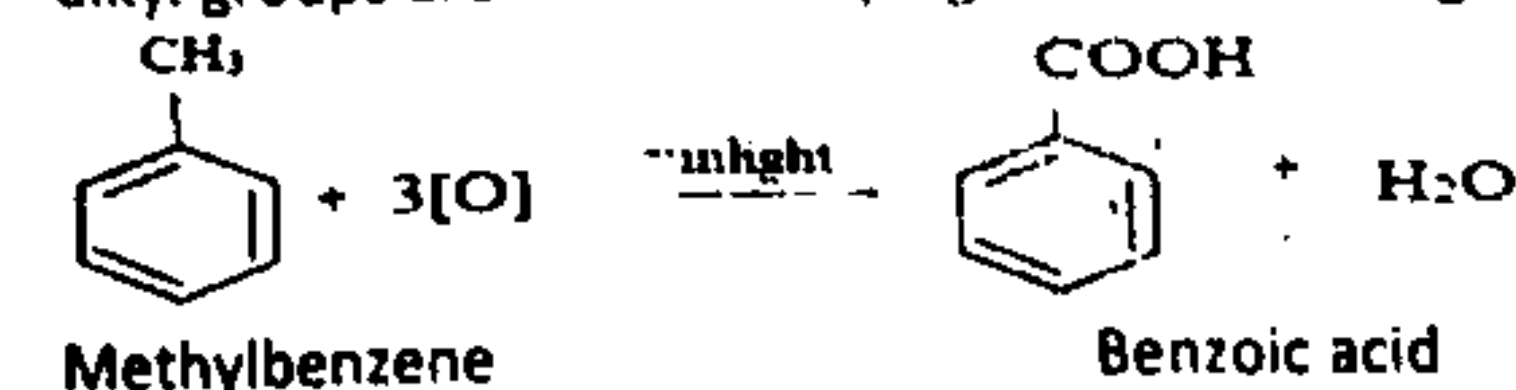
(ii). Benzene reacts with chlorine and bromine in the presence of sunlight to give addition products, hexachlorobenzene or hexabromobenzene.

$$C_6H_6 + 3Br_2 \xrightarrow{\text{sunlight}} C_6H_6Br_6$$

Hexabromobenzene

55. What happens when Acidified $KMnO_4$ is added to Methylbenzene and Ethylbenzene?

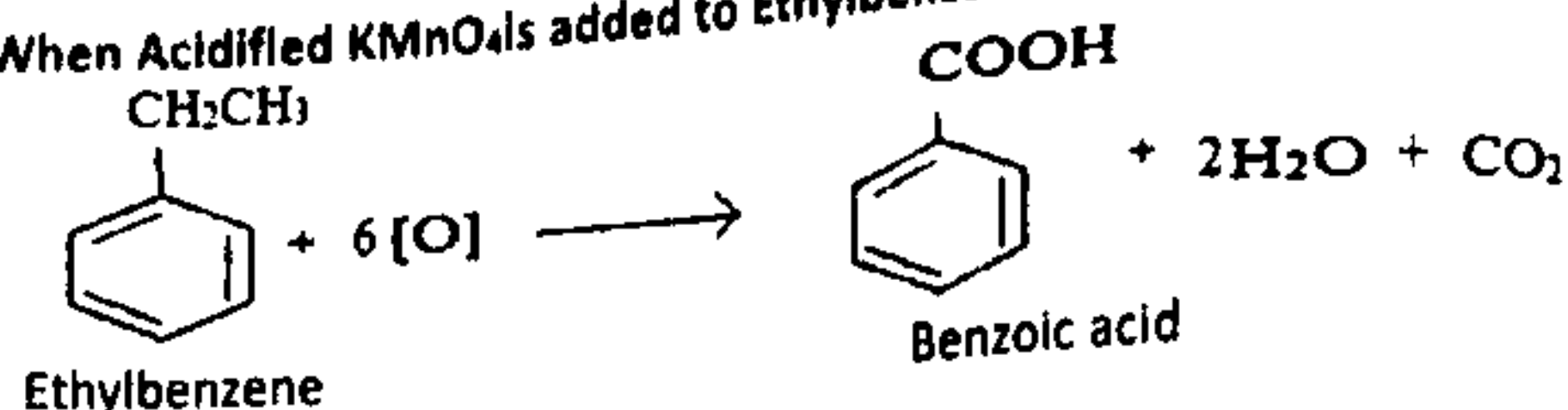
Ans **When Acidified $KMnO_4$ is added to Methylbenzene:**

Alkyl benzenes re readily oxidized by acidified $KMnO_4$. In these reactions, the alkyl groups are oxidized keeping the benzene ring intact.

$$C_6H_5CH_3 + 3[O] \xrightarrow{\text{sunlight}} C_6H_5COOH + H_2O$$

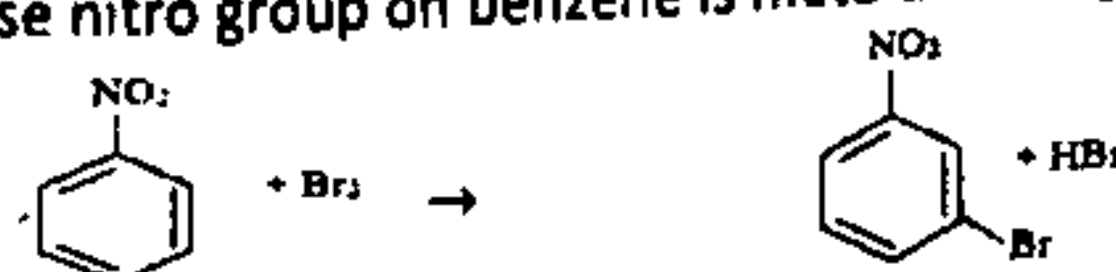
Methylbenzene Benzoic acid

56. **When Acidified $KMnO_4$ is added to Ethylbenzene:**

$$C_6H_5CH_2CH_3 + 6[O] \longrightarrow C_6H_5COOH + 2H_2O + CO_2$$

Ethylbenzene → Benzoic acid

Topic No: 9.5.4

57. **Predict major product of bromination of nitrobenzens. Also give equation.**

Ans: m-bromonitro benzene is the major product of bromination of nitrobenzene because nitro group on benzene is meta directing as:

$$C_6H_5NO_2 + Br_2 \rightarrow m\text{-}BrC_6H_4NO_2 + HBr$$

58. **Why hydroxyl group (OH^-) is ortho and para directing?**

Ans: Hydroxyl group release electrons to the benzene ring, thereby facilitating the availability of electrons to the electrophiles at ortho and para positions. This result in the icreased chemical reactivity of benzene ring toward electrophiles. The benzene ring can offer more than one position to the new incoming groups.

59. **Write names of any four ortho – para directing groups?**

Ans: $-N(CH_3)_2$, $-NH_2$, $-OH$, $-OCH_3$, $-Cl$, $-Br$, $-I$

60. **What is meant by meta directing group?** (3 times)

Ans: <u>Meta directing group:</u>-The groups which withdraw the electrons of the benzene ting towards themselves, and reduce the availability to the electrophile are called meta directing groups. The result is the decreased chemical reactivity of benzene. In their presence incoming electrophile will prefer to attack on meta position rather than ortho and para positions. For example: $-N^+R_3$, $-C\equiv N$ etc.

61. **What is meant by directive influence of substituent? Give an example?**

Ans When an electrophile substitution reaction takes place on the benzene ring, we get only one monsubstituted benzene all the six positions in the ring are equivalent. However introduction of second group into the ring may give three isomeric distributed products, ortho, meta and para.
For example chlorination of nitrobenzene give only meta chloronitro benzene while nitration of chlorobenzene gives orthochloronitrobenzene.

62. **How will you prepare 2, 4, 6 – trinitrotoluene from benzene in two steps?**

Ans

(i). $R-Cl + AlCl_3 \longrightarrow AlCl_4^- + R^+$

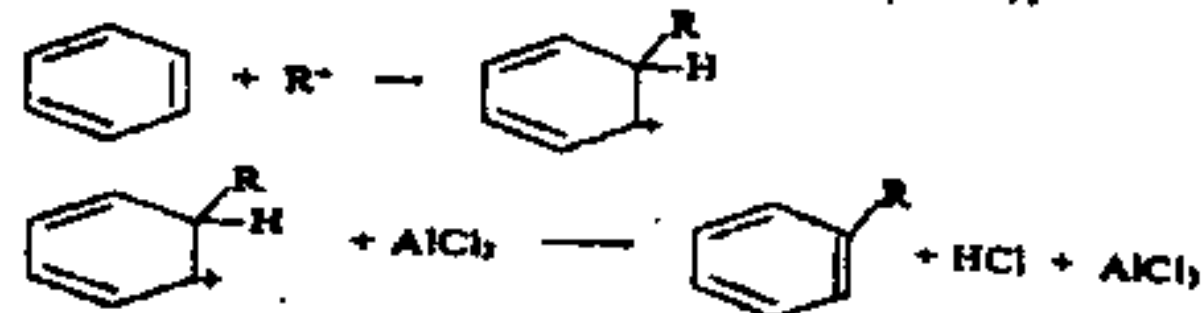
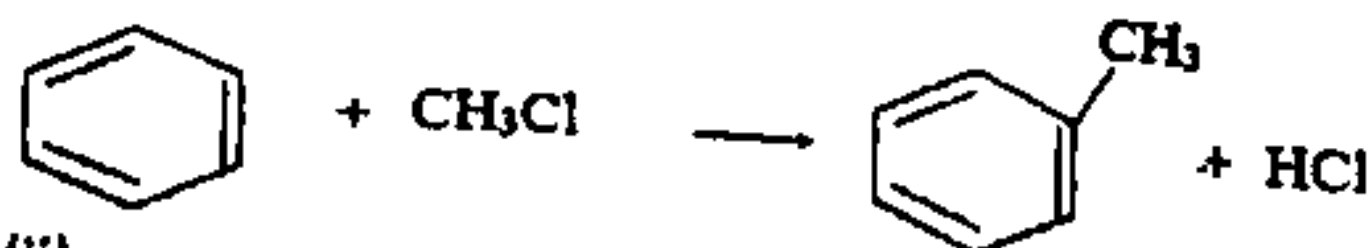
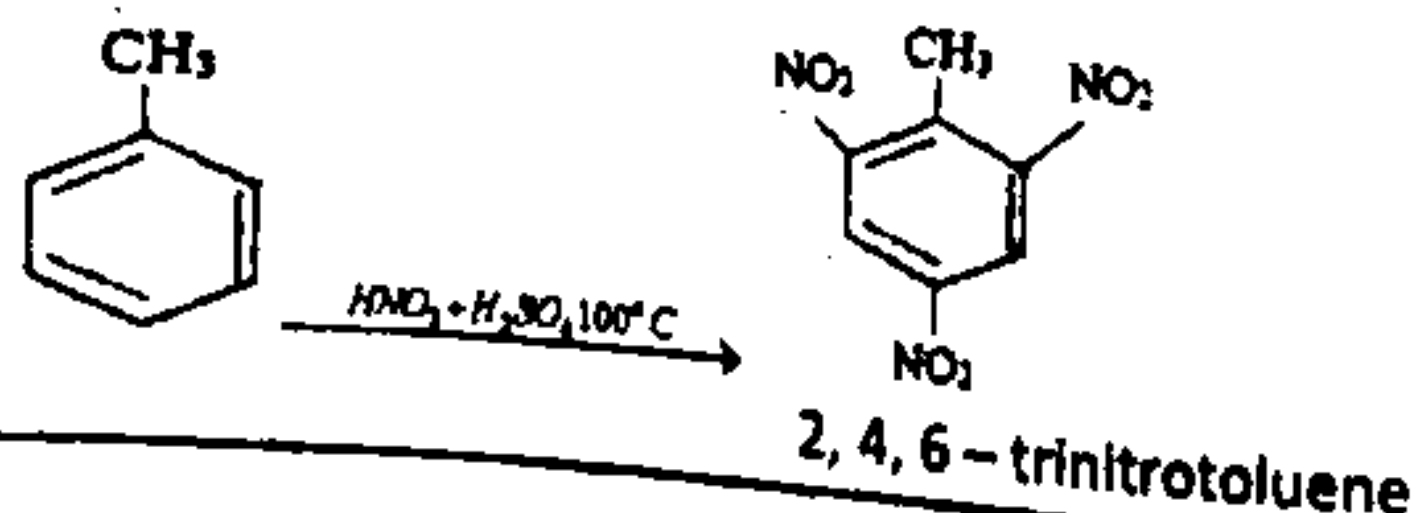
$$C_6H_6 + R^+ \longrightarrow C_6H_6R^+$$

$$C_6H_6R^+ + AlCl_4^- \longrightarrow C_6H_5R + HCl + AlCl_3$$

Example:

$$C_6H_6 + CH_3Cl \longrightarrow C_6H_5CH_3 + HCl$$

(ii).

$$C_6H_5CH_3 \xrightarrow{HNO_3 + H_2SO_4,\ 100^\circ C} C_6H_2(CH_3)(NO_2)_3$$

2, 4, 6 – trinitrotoluene

63. **How will you prepare o-nitrotoluene from benzene in two steps?**

Ans (i). $R-Cl + AlCl_3 \longrightarrow AlCl_4^- + R^+$

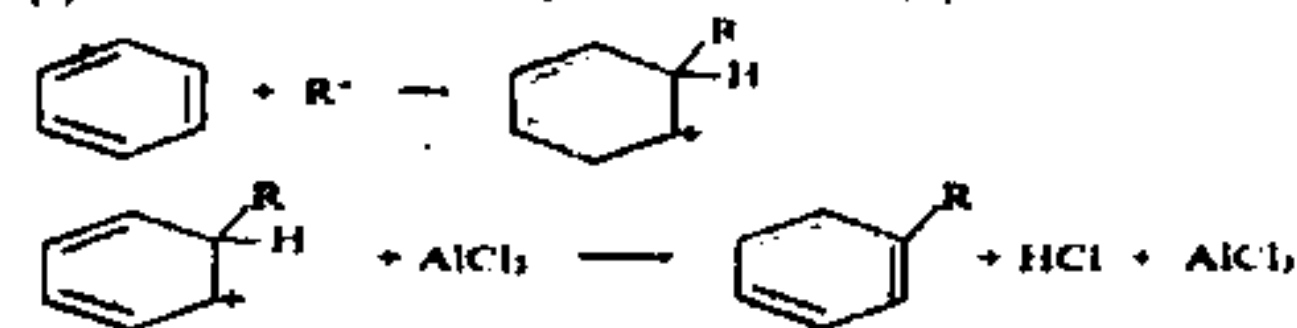
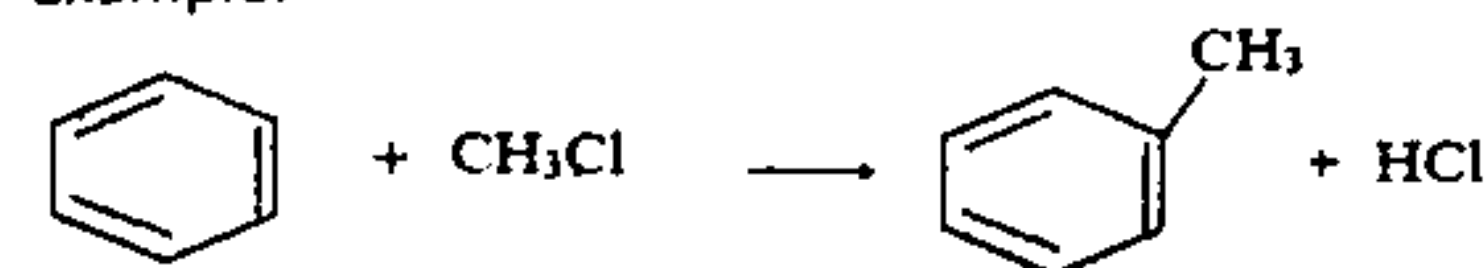
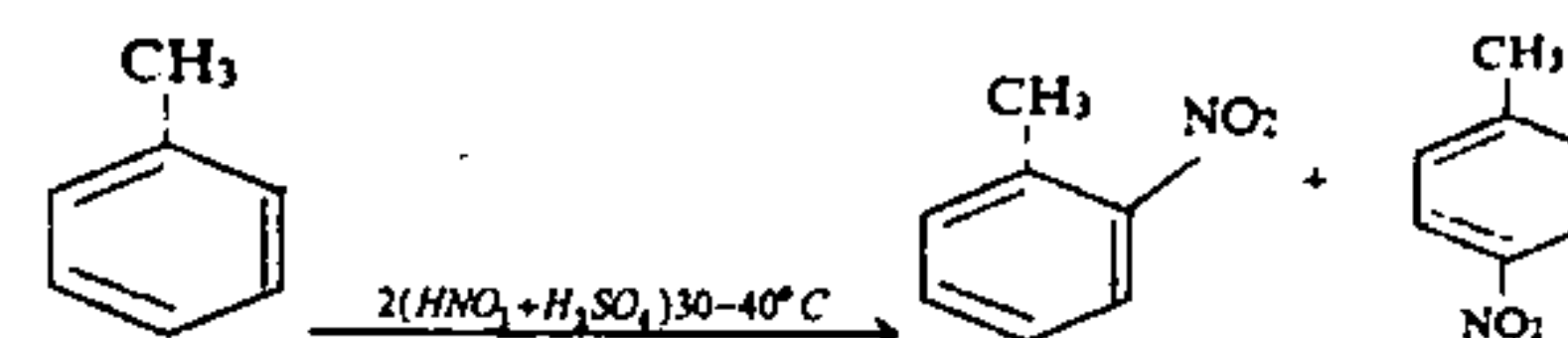
$$C_6H_6 + R^+ \longrightarrow C_6H_6R^+$$

$$C_6H_6R^+ + AlCl_4^- \longrightarrow C_6H_5R + HCl + AlCl_3$$

Example:

$$C_6H_6 + CH_3Cl \longrightarrow C_6H_5CH_3 + HCl$$

(ii).

$$C_6H_5CH_3 \xrightarrow{2(HNO_3 + H_2SO_4)\ 30-40^\circ C} o\text{-}CH_3C_6H_4NO_2 + p\text{-}CH_3C_6H_4NO_2$$

Topic No: 9.6

64. **Justify that Ethene (C_2H_4) is more reactive than C_6H_6**

Ans The highly sable, delocalized electrons of benzene ring not readily available for the nucleophilic attack like the electrons of alkenes. Therefore, the electrons of benzne ring do not assist in the attack of weak electrophiles.

LONG QUESTIONS OF CHAPTER-9 AROMATIC HYDROCARBON ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 9.1

1. **Explain classification of aromatic hydrocarbons on the basis of number of rings.**

Ans: (Text Book Page No:170)

Topic No: 9.3.5

2. **Describe the structure of benzene on the basis of atomic orbital treatment.** (7 times)

Ans: (Text Book Page No:175)

3. **Explain stability of Benzene.**

Ans: (Text Book Page No:175)

4. **Draw structural formulae of following compounds. (i) m-chlorobenzoic acid (ii) P- nitroaniline (iii) 2-amino-5-bromo-3-nitro benzene sulphonic acid (iv) m-nitrophenol**

Ans: (Text Book Page No:)

Topic No: 9.3.7

5. **What is resonance? Explain structure of benzene by resonance method.**

Ans: (Text Book Page No:177) (2 times)

Topic No: 9.4

6. **Write four methods for the preparation of benzene.** (4 times)

Ans: (Text Book Page No:178)

7. **Discuss two Industrial and two laboratory methods to prepare benzene.**

Ans: (Text Book Page No178:)

Topic No: 9.5.2

8. What are Friedel- Crafts reactions? Explain mechanisms of alkylation & acylation of benzene. (9 times)

Ans: (Text Book Page No:184)

9. What happens when toluene is reacts with:
Cl₂ in the presence of sunlight ii) KMnO₄ in the presence of H_2SO_4

Ans: (Text Book Page No:182+187)

10. Convert benzene into : (i) Cyclohexane (ii) Maleic acid (iii) Glyoxal (iv) Benzene sulphonic acid.

Ans: (Text Book Page No:186)

Topic No: 9.5.2/1

11. How benzene is prepared from cyclohexane, Acetylene alkanes.

Ans: (Text Book Page No:179)

12. Explain the mechanism of halogeneation of benzene.

Ans: (Text Book Page No:182)

Topic No: 9.5.2/2

13. Write the mechanism for: (7 times)
Sulphonation ii) Nitration of Benzene

Ans: (Text Book Page No:183)

14. What is sulphonation? Give its mechanism. (2 times)

Ans: (Text Book Page No:183)

Topic No: 9.5.2/4

15. DefineFriedel Crafts reactions. Give mechanism with an example of Friedel Craft's acylation reaction.

Ans: (Text Book Page No:184)

16. Describe the Mechanism of Friedalcraft's alkylation of Benzene. (8 times)

Ans: (Text Book Page No:184)

17. What is Friedel Craft's alkylation reaction? Give its mechanism.

Ans: (Text Book Page No:184)

Topic No: 9.5.3/1

18. Write four reactions in which benzene behaves as if it is a saturated hydrocarbon.

Ans: (Text Book Page No:181)

Topic No: 9.5.4

19. What is meant by orientation? Why certain substituent's are ortho and para directive and others are meta directive giving one example.

Ans: (Text Book Page No:188)

20. How will you prepare these compounds from benzene? (3 times)
(i) m-Chloronitrobenzene ii) p-Choronitrobenzene

Ans: (Text Book Page No:188)

21. Predict the major products of bromination of following compounds.
(i) Toluene (ii) nitrobenzene (iii) Bromobenzene (iv) Benzoic acid

Ans: (Text Book Page No:186)

OBJECTIVES (MCQ'S) OF CHAPTER-10
ALKYL HALIDES
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 10.1

1- In primary alkyl halides the halogen atom is attached to a carbon which is further attached to how many carbon atoms? (2 times)

(a) Four (b) Three (c) Two (d) One

Topic No: 10.5

2. For which mechanism, the first step involved is the same: (7 times)

(a) E1 and E2 (b) E_1 and S_N1 (c) E_1 and S_N2 (d) E_2 and S_N2

3. Which of the following is electrophile?

(a) NH_3 (b) H_2O (c) BF_3 (d) Cl

Topic No: 10.5.1

4. Which one of the following is not a nucleophile? (10 times)

(a) H_2O (b) H_2S (c) BF_3 (d) NH_3

5- Which one of following is best nucleophile? (2 times)

(a) H_2O (b) NH_3 (c) $C_2H_5O^-$ (d) NO

6. Which one is the best leaving group?

(a) I^{-1} (b) Br^{-1} (c) Cl^{-1} (d) F^{-1}

Topic No: 10.5.2

7. In S_N2 mechanism, the rate of bond formation is ____________ bond breakage?

(a) less than (b) equal to (c) greater than (d) cannot be predicted

8. Order and molecularity, of S_N2 reaction of alkyl halidc is:

(a) 1,2 (b) 2,1 (c) 2,2 (d) 0,1

9- S_N2 reactions can be carried out with: (4 times)

(a) primary alkyl halides (b) secondary alkyl halides (c) tertiary alkyl halides (d) all of these

Topic No: 10.5.3

10. Elimination bimolecular reactions involve: (6 times)

(a) First order kinetics (b) Second order kinetics
(c) Third order kinetics (d) Zero order kinetics

11. Ethyl bromide reacts with aqueous KOH to produce is:

(a) Ethene (b) Ethane (c) Ethanol (d) Ethanoic acid

2018

12. The rate of E1 reaction depends upon:

(a) The concentration of substrate (b) The concentration of nucleophile
(c) The concentration of substrate as well as nucleophile (d) none of these

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

1	2	3	4	5	6	7	8	9	10	11	12
D	B	C	C	C	A	B	C	A	B	C	A

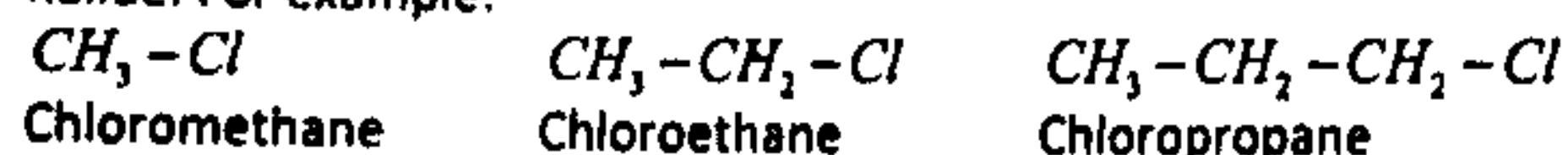
SHORT QUESTIONS OF CHAPTER-10
ALKYL HALIDES
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 10.1

1. What are primary and tertiary Alkyl Halides? Give examples. (5 times)

Ans: In a primary alkyl halide halogen atom is attached with a carbon which is further attached to one or no carbon atom. For example: CH_3Cl, CH_3-CH_2-Cl etc.
In a tertiary alkyl halide halogen atom is attached with a carbon which is further attached to three carbon atoms. For example: $(CH_3)_3C$-Cl (2-chloro,2-methylpropane) etc.

2. Define Primary Alkyl Halids and secondary alkyl Halids give example of each. (2 times)

Ans: **Primary Alkyl Halids**: The alkyl halids in which halogen atom is attached with a carbon which is further attached to one or no carbon atom is called primary alkyl halide. For example:

CH_3-Cl Chloromethane; CH_3-CH_2-Cl Chloroethane; $CH_3-CH_2-CH_2-Cl$ Chloropropane

Secondary alkyl Halids: The alkyl halids in which halogen atom is attached with a carbon which is further attached to two carbon atom is called secondary alkyl halide. For example: $(CH_3)_2C-Cl$ 2-Chloropropane

3. Define Alkyl halides. Give one example of primary alkyl halides.

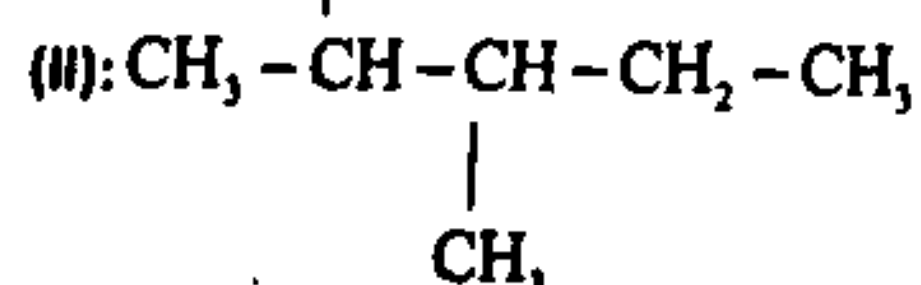
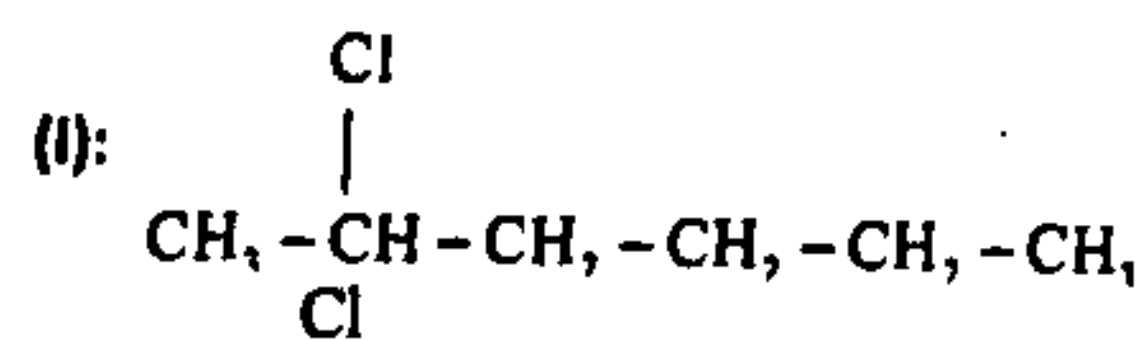
Ans: "Monohaloalkanes are called alkyl halides."
Their general formula is $R-X$.
CH_3-Br, CH_3-CH_2-Cl are primary alkyl halides

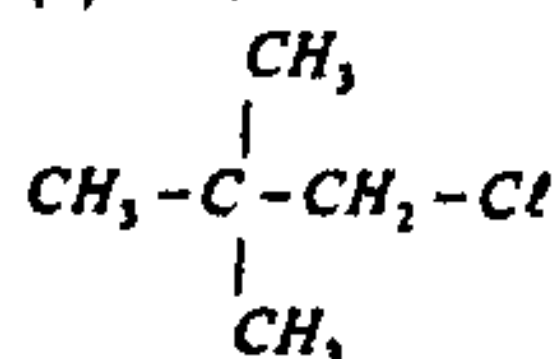
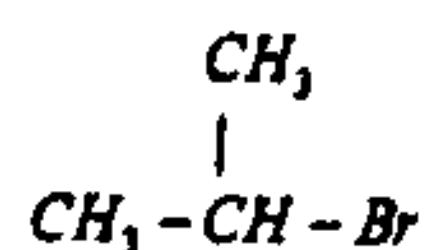
Topic No: 10.2

4. Draw two possible structures that have molecular formula $C_6H_{13}Cl$

Ans:

(I): $CH_3-CH(Cl)-CH_2-CH_2-CH_2-CH_3$

(II): $CH_3-CH(Cl)-CH(CH_3)-CH_2-CH_3$

5. Give IUPAC names of following compounds.

(a) $(CH_3)_3C-CH_2-Cl$ (b) $(CH_3)_2CH\ Br$

Ans: (a) $CH_3-C(CH_3)_2-CH_2-Cl$ 1-chloro-2, 2 dimethylpropane

(b) $CH_3-CH(CH_3)-Br$ 2-bromopropane

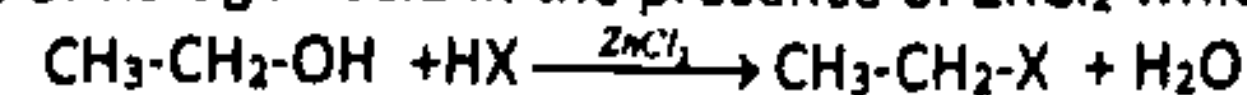
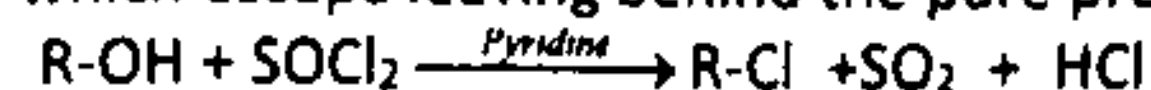
Topic No: 10.3

6. Prepare alkyl halides from alcohols by two methods? (7 times)

Ans: (I).. Alcohol may be converted to the corresponding alkyl halides by the action of halogen acid in the presence of $ZnCl_2$ which acts as a catalyst.

$$CH_3-CH_2-OH + HX \xrightarrow{ZnCl_2} CH_3-CH_2-X + H_2O$$

(II).. Alcohols react with thionyl chloride in pyridine as a solvent to give alkyl chlorides. This method is especially useful since the by-products (HCl, SO_2) are gases, which escape leaving behind the pure product.

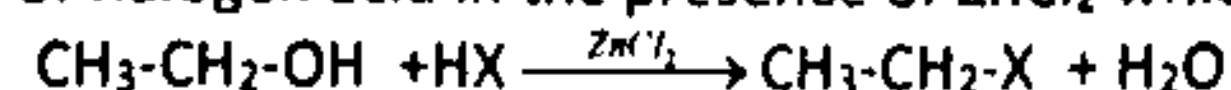
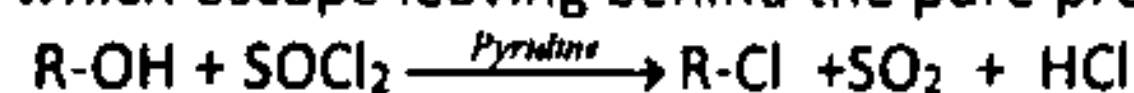
$$R-OH + SOCl_2 \xrightarrow{Pyridine} R-Cl + SO_2 + HCl$$

7. Write down any two methods for the preparation of Alkyl halides?

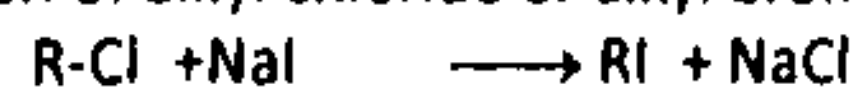
Ans: (I).. **Preparation of alkyl halides from alcohols:-**

(a).. Alcohol may be converted to the corresponding alkyl halides by the action of halogen acid in the presence of $ZnCl_2$ which acts as a catalyst.

$$CH_3-CH_2-OH + HX \xrightarrow{ZnCl_2} CH_3-CH_2-X + H_2O$$

(b).. Alcohols react with thionyl chloride in pyridine as a solvent to give alkyl chlorides. This method is especially useful since the by-products (HCl, SO_2) are gases, which escape leaving behind the pure product.

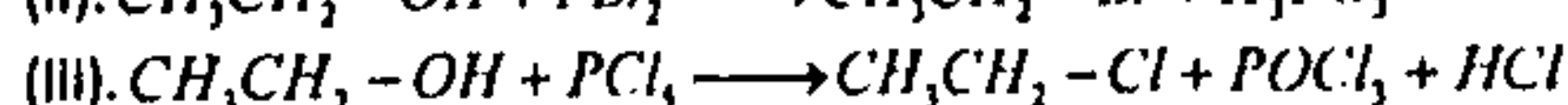
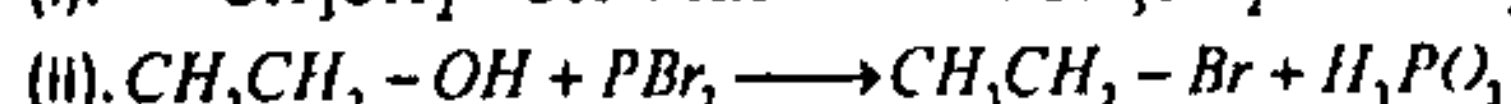
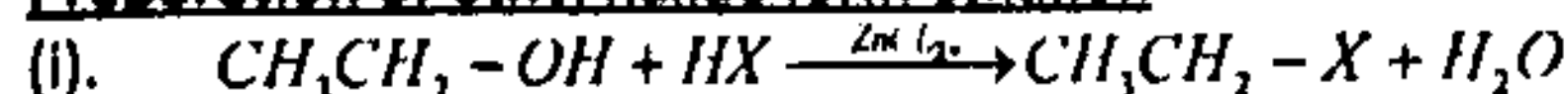
$$R-OH + SOCl_2 \xrightarrow{Pyridine} R-Cl + SO_2 + HCl$$

(II).. A method for the preparation of simple alkyl iodide is carried out by reaction of alkyl chloride or alkyl bromide with sodium iodide.

$$R-Cl + NaI \longrightarrow RI + NaCl$$
$$R-Br + NaI \longrightarrow RI + NaBr$$

8. Describe two methods of preparation of ethyl halide form ethanol. (2 times)

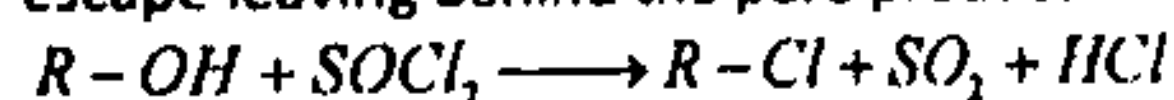
Ans: **Preparation of ethyl halide form ethanol:**

(I). $CH_3CH_2-OH + HX \xrightarrow{ZnCl_2} CH_3CH_2-X + H_2O$

(II). $CH_3CH_2-OH + PBr_3 \longrightarrow CH_3CH_2-Br + H_3PO_3$

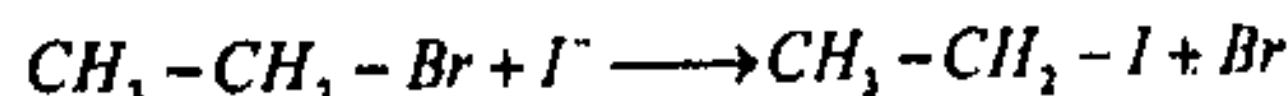
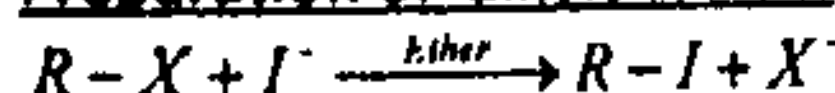
(III). $CH_3CH_2-OH + PCl_5 \longrightarrow CH_3CH_2-Cl + POCl_3 + HCl$

9. How will you prepare Ethyl chloride using thionylchloride.

Ans: Alcohols react with thionyl chloride in pyridine as a solving to give alkyl chlorides. This method is especially useful since the by-products (HCl, SO_2) are gases, which escape leaving behind the pure product.

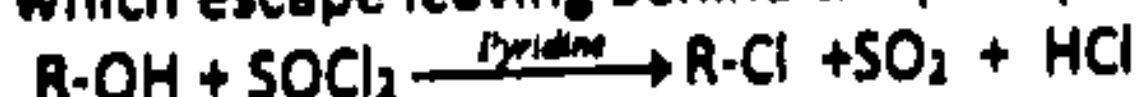
$$R-OH + SOCl_2 \longrightarrow R-Cl + SO_2 + HCl$$

10. Write excellent method to prepare alkyle iodide. (2 times)

Ans: **Preparation of alkyle iodide:**

$$R-X + I^- \xrightarrow{Ether} R-I + X^-$$

$$CH_3-CH_2-Br + I^- \longrightarrow CH_3-CH_2-I + Br$$

11. $SOCl_2$ is the best reagent to get alkyl chloride from alcohols. Write equation including solvent necessary to complete their reaction. (2 times)

Ans: **Preparation of alkyl chloride from alcohols:**
Alcohols react with thionyl chloride in pyridine as a solvent to give alkyl chlorides. This method is especially useful since the by-products (HCl, SO_2) are gases, which escape leaving behind the pure product.

$$R-OH + SOCl_2 \xrightarrow{Pyridine} R-Cl + SO_2 + HCl$$

Topic No: 10.5

12. Explain terms: (I).. Leaving group (II).. Electrophile (2 times)

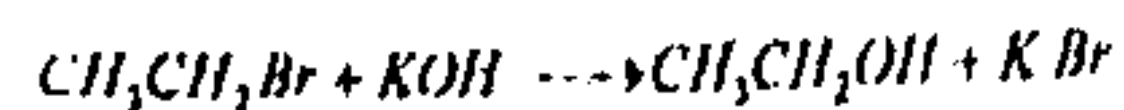
Ans: **(I).. Leaving group**: Leaving group is nucleophile which leaves during substitution reaction of alkyl halide. It departs with an unshared pair of electrons. If we wish a S_N reaction to proceed in the forward direction the incoming nucleophile must be stronger than the departing one. Cl^-, Br^-, I^-, HSO_4^- are good leaving groups. Poor leaving groups are OH^-, OR^- and NH_2^-. Iodide ion is a good nucleophile as well as a good leaving group.

(iii).. **Electrophile:** It is a specie which attracts electrons (electron loving). The carbon atom of an alkyl group attaches with the halogen atom and bearing a partial positive charge is called an electrophile center. An electrophile may be neutral or positively charged.

13. What is a Nucleophilic substitution reaction. Give example.

Ans: Those reactions in which halogen of Alkyl halide is replaced by other nucleophile (e.g; OH, NH_2 etc) is called Nucleophilic substitution reaction.

Example:

$$CH_3CH_2Br + KOH \longrightarrow CH_3CH_2OH + KBr$$

Topic No: 10.5.1

14. What is leaving group? Give examples. **(5 times)**

Ans: **Leaving group:-** Leaving group is nucleophile which leaves during substitution reaction of alkyl halide. It departs with an unshared pair of electrons. If we wish a S_N reaction to proceed in the forward direction the incoming nucleophile must be stronger than the departing one. Cl^-, Br^-, I^-, HSO_4^- are good leaving groups. Poor leaving groups are OH^-, OR^- and NH_2^-. Iodide ion is a good nucleophile as well as a good leaving group.

15. Define electrophile and nucleophile? **(7 times)**

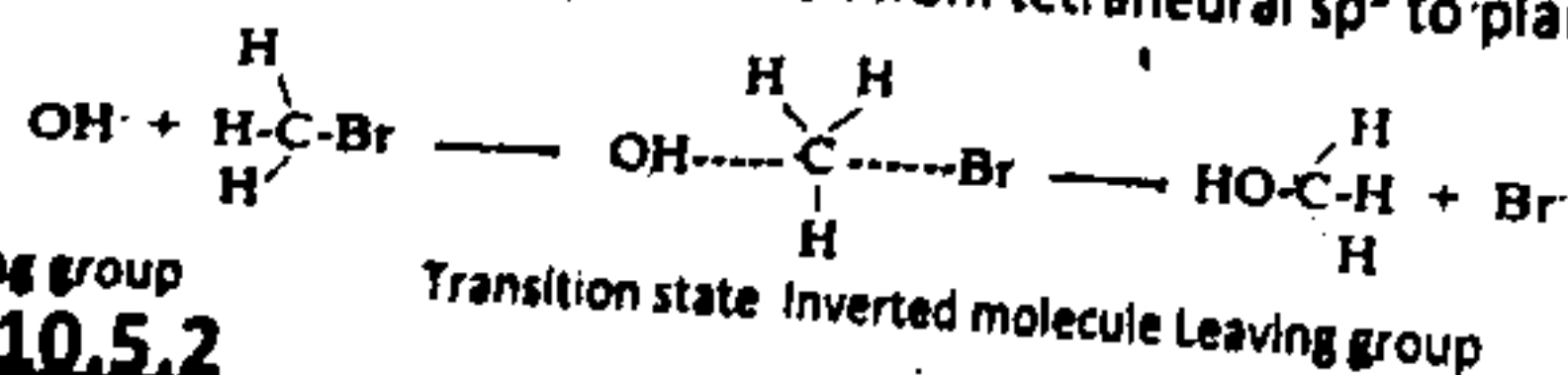
Ans: **Electrophile:** It is a specie which attracts electrons (electron loving). The carbon atom of an alkyl group attaches with the halogen atom and bearing a partial positive charge is called an electrophilic center. An electrophile may be neutral or positively charged.

Nucleophile: Nucleophile means nucleus loving. It has an unshared electron pair available for bonding and in most cases it is basic in character. It may have negatively charged or neutral. For example: HO^-, Cl^-, Br^-, I^-, NH_3 etc.

16. Why does SN_2 mechanism give a product with inversion of configuration? Show with one reaction.

Ans: In nucleophilic substitution bimolecular (S_N2) the direction of attack of the attaching nucleophile is from the side which is opposite to the leaving group. In order to give to the nucleophile enough room to attack, the substrate carbon atom changes its state of hybridization from tetrahedral sp^3 to planar sp^2.

$$OH^- + H\text{-}C(H)(H)\text{-}Br \longrightarrow OH\cdots C(H)(H)(H)\cdots Br \longrightarrow HO\text{-}C(H)(H)\text{-}H + Br^-$$

Attacking group — Transition state — Inverted molecule — Leaving group

Topic No: 10.5.2

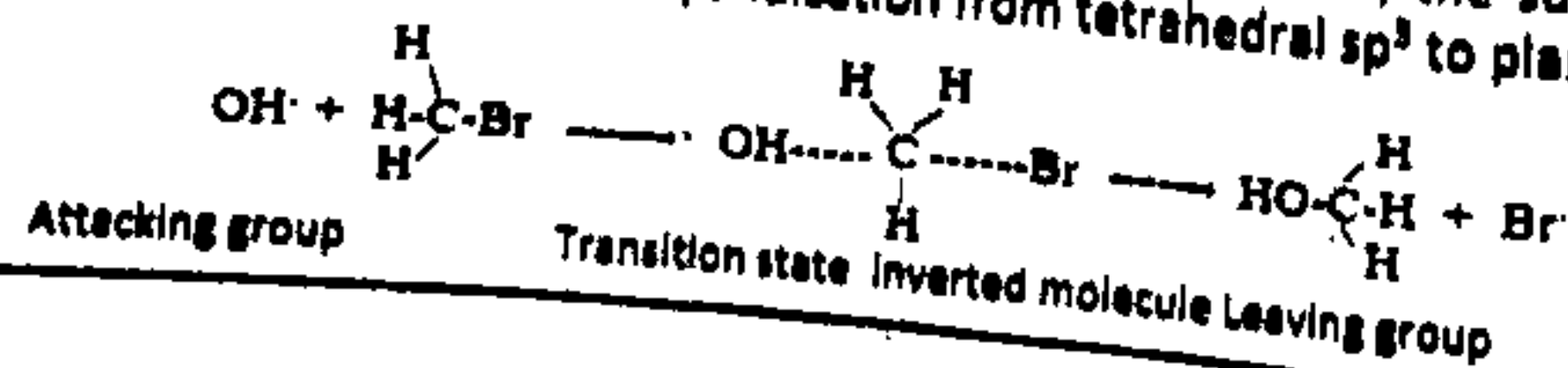
17. During S_N1 reaction. What is the significance of first step?

Ans: The first step involved the breakage of a covalent bond so it is a slow step as compared to the second step which involves the energetically favourable combination of ions. The first step is, therefore, called the rate-determining step. The mechanism is called unimolecular because only one molecule takes part in the rate determining step.

18. Give general mechanism patterns of S_N2 reaction? **(5 times)**

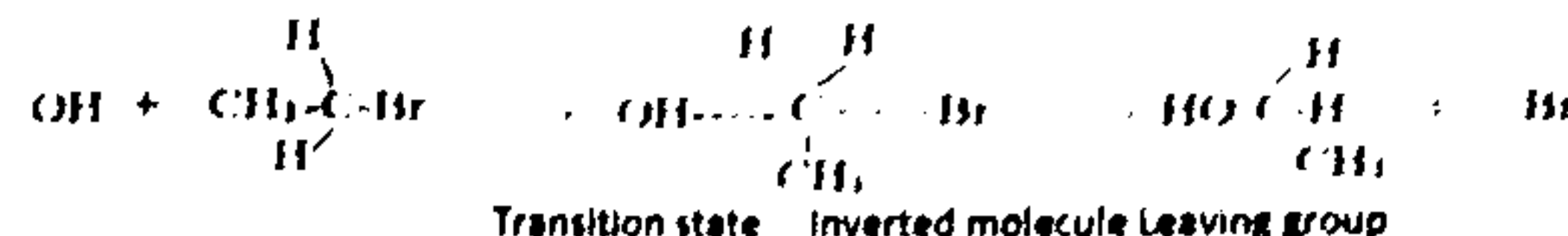
Ans: In nucleophilic substitution bimolecular (S_N2) the direction of attack of the attaching nucleophile is from the side which is opposite to the leaving group. In order to give to the nucleophile enough room to attack, the substrate carbon atom changes its state of hybridization from tetrahedral sp^3 to planar sp^2.

$$OH^- + H\text{-}C(H)(H)\text{-}Br \longrightarrow OH\cdots C(H)(H)(H)\cdots Br \longrightarrow HO\text{-}C(H)(H)\text{-}H + Br^-$$

Attacking group — Transition state — Inverted molecule — Leaving group

19. Reaction of ethyl bromide with OH nucleophile is S_N2. Justify?

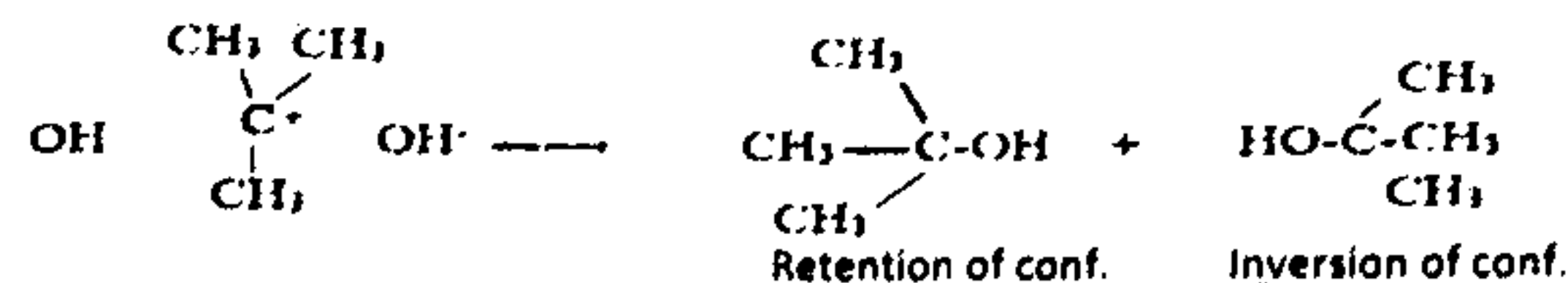
Ans: In nucleophilic substitution bimolecular (S_N2) the direction of attack of OH^-, the attaching nucleophile is from the side which is opposite to the leaving group. In order to give to the nucleophile enough room to attack on ethyl bromide, the substrate carbon atom changes its state of hybridization from tetrahedral sp^3 to planar sp^2

$$OH^- + CH_3\text{-}C(H)(H)\text{-}Br \longrightarrow OH\cdots C(H)(H)(CH_3)\cdots Br \longrightarrow HO\text{-}C(H)(H)(CH_3) + Br^-$$

Transition state — Inverted molecule — Leaving group

20. Inversion of configuration is 50% in S_N1 mechanism. Explain?

Ans: **Inversion of configuration:-** In S_N1 mechanism, the nucleophile attacks when the leaving group had already gone, carbocation is a planar specie allowing the nucleophile to attack on it from both the directions with equal ease. We, therefore, observe 50% inversion of configuration and 50% retention of configuration.

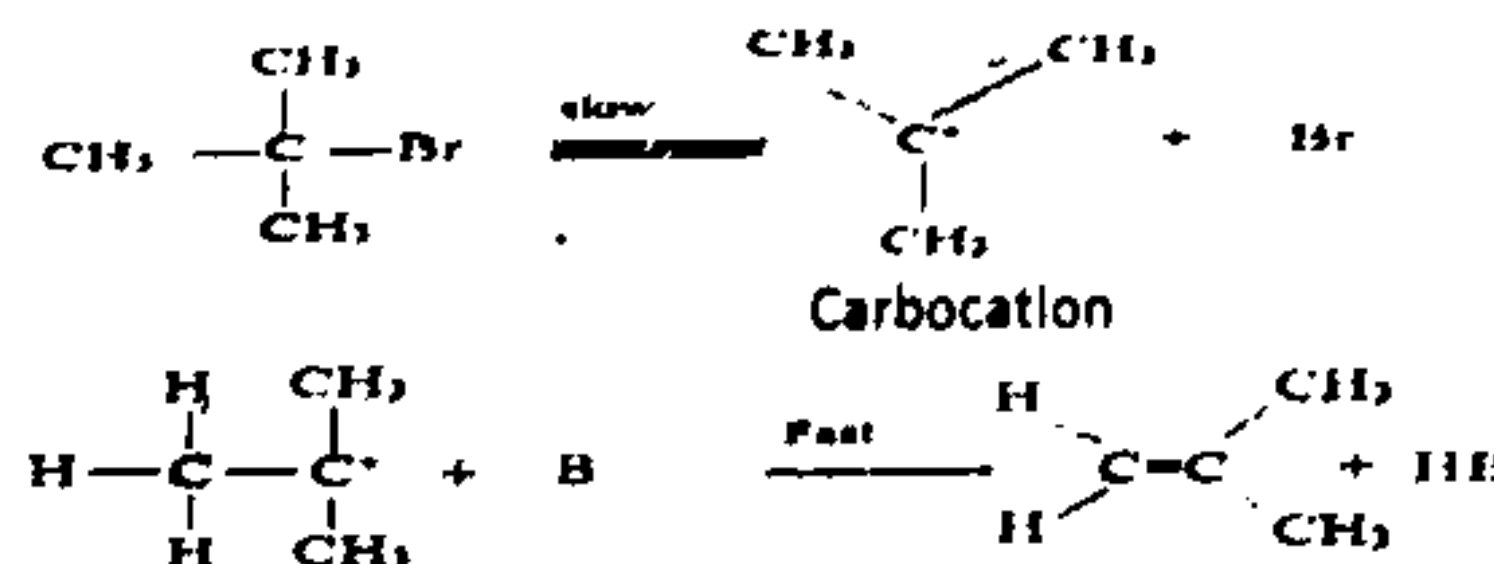
$$OH^- \;\; (CH_3)_3C^+ \;\; OH^- \longrightarrow (CH_3)_3C\text{-}OH + HO\text{-}C(CH_3)_3$$

Retention of conf. — Inversion of conf.

21. Complete the elimination reaction in two steps when a base B attacks on t-butyl bromide?

Ans: **Completion of the elimination reaction:-**

$$(CH_3)_3C\text{-}Br \xrightarrow{slow} (CH_3)_3C^+ + Br^-$$

Carbocation

$$H\text{-}CH_2\text{-}C^+(CH_3)_2 + B \xrightarrow{Fast} H_2C{=}C(CH_3)_2 + HB$$

22. Give two examples of nucleophilic substitution reactions?

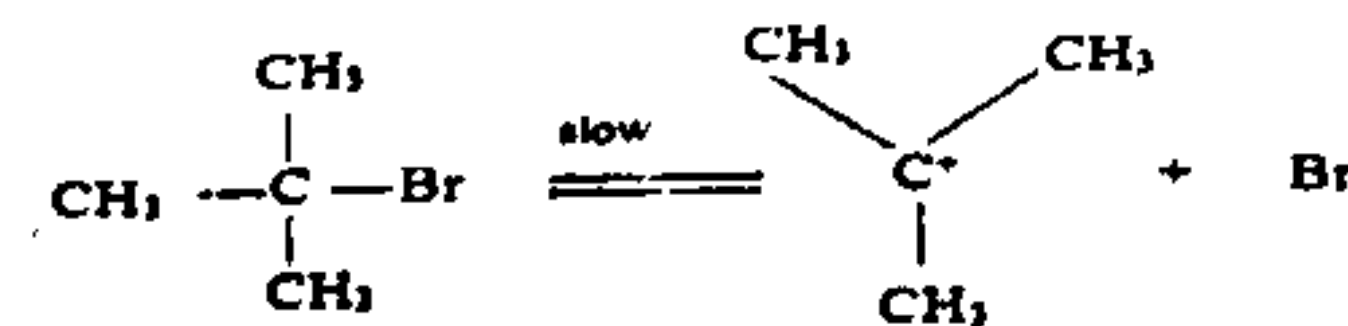
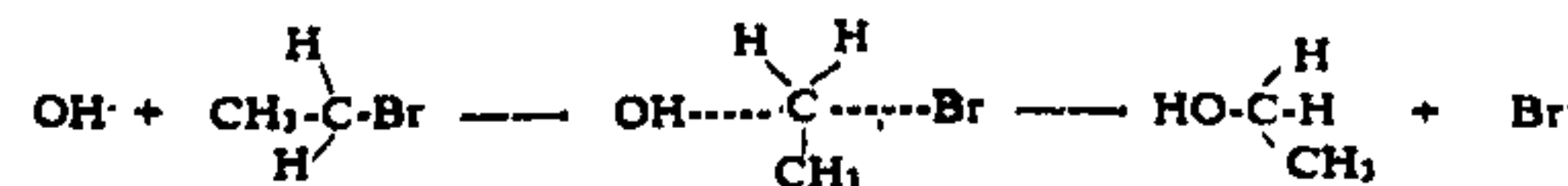
Ans: (i).. S_N1 Two step reaction mechanism:

Step 1:

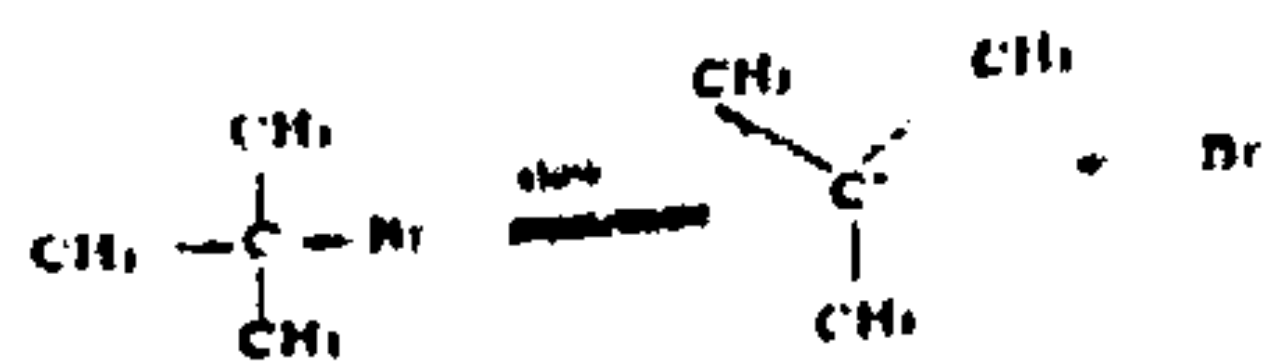
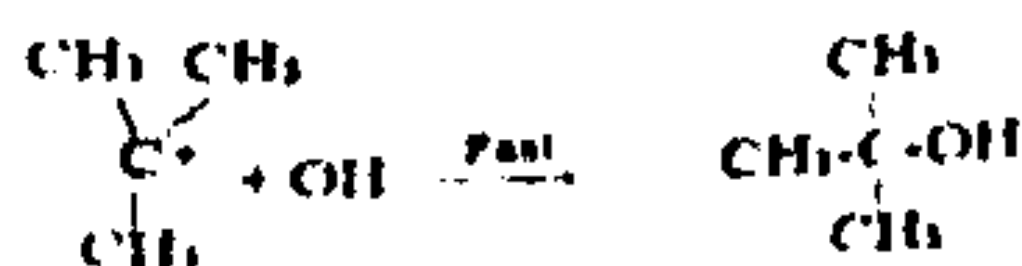
$$(CH_3)_3C\text{-}Br \xrightarrow{slow} (CH_3)_3C^+ + Br^-$$

Step 2:

$$(CH_3)_3C^+ + OH^- \xrightarrow{Fast} (CH_3)_3C\text{-}OH$$

$$OH^- + CH_3\text{-}C(H)(H)\text{-}Br \longrightarrow OH\cdots C(H)(H)(CH_3)\cdots Br \longrightarrow HO\text{-}C(H)(H)(CH_3) + Br^-$$

23. Give mechanism of S_N1 reaction? **(2 times)**

Ans: **Mechanism of S_N1 reaction:-**

Step 1:

$CH_3-C(CH_3)_2-Br \xrightarrow{slow} (CH_3)_3C^+ + Br^-$

Step 2:

$(CH_3)_3C^+ + OH^- \xrightarrow{Fast} CH_3-C(CH_3)_2-OH$

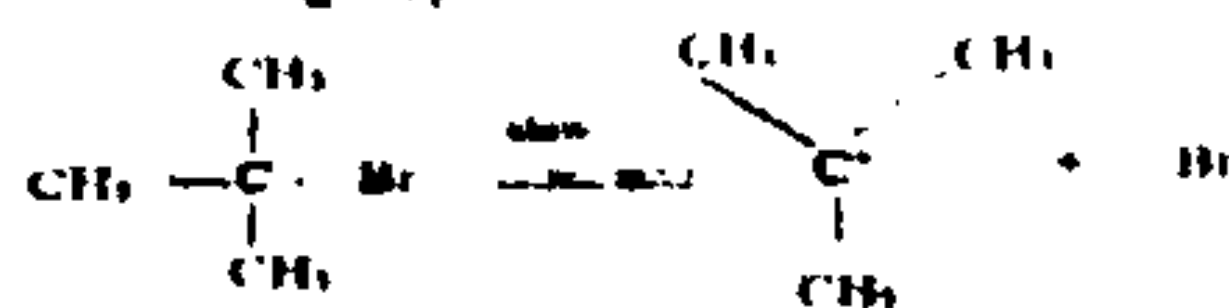
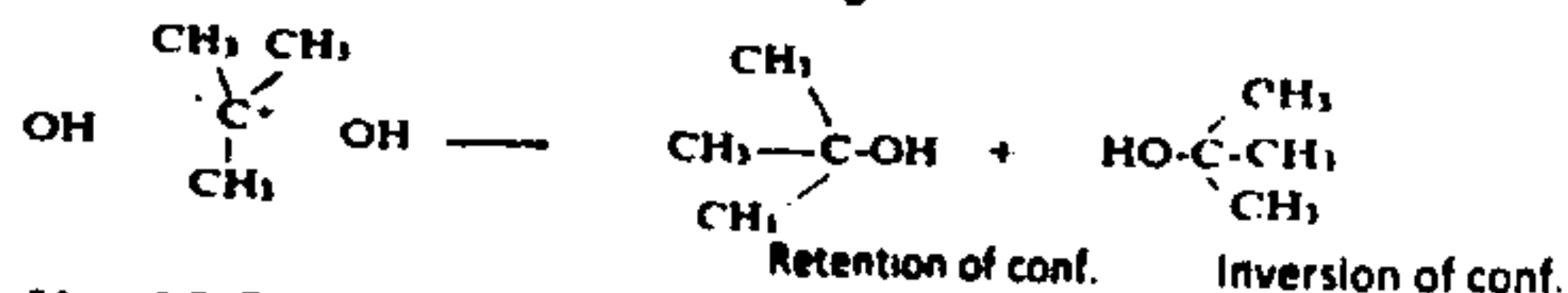
The first step involved the breakage of a covalent bond so it is a slow step as compared to the second step which involves the energetically favourable combination of ions. The first step is therefore called the rate-determining step. The mechanism is calledunimolecular because only one molecule takes part in the rate determining stip.

24. What is the role of stability of carbonium ion in deciding the Mechanism of substitution reaction.

Ans: The first step involved the breakage of a covalent bond so it is a slow step as compared to the second step which involves the energetically favourable combination of ions. The first step is, therefore, called the rate-determining step. The mechanism is called unimolecular because only one molecule takes part in the rate determining step.

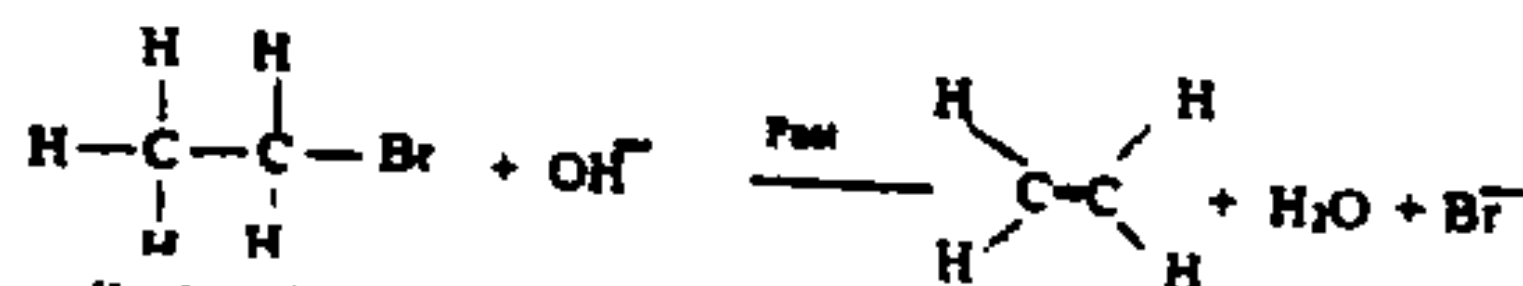
$CH_3-C(CH_3)_2-Br \xrightarrow{slow} (CH_3)_3C^+ + Br^-$

In S_N1 mechanism, the nucleophile attacks when the leaving group had already gone, carbocation is a planar specie allowing the nucleophile to attack on it from both the directions with equal ease. We, therefore, observe 50% inversion of configuration and 50% retention of configuration.

$OH^- + (CH_3)_3C^+ + OH^- \longrightarrow CH_3-C(CH_3)_2-OH + HO-C(CH_3)_2-CH_3$

Retention of conf. Inversion of conf.

Topic No: 10.5.3

25. Discuss E2 mechanism. (4 times)

Ans: E2 mechanism:-In E2 mechanism, the nucleophile attacks and the leaving group leaves at the same time with a formation of carbon-carbon double bond. The single step E2 elimination:

$H-CH_2-CH_2-Br + OH^- \xrightarrow{Fast} H_2C=CH_2 + H_2O + Br^-$

26. What are elimination reactions? Give example of E1 reactions. (3 times)

Ans: When nucleophile attacks on hydrogen atom attached to the β-carbon of the alkyl halide, we get an alkene, such type of reactions are called elimination reactions.

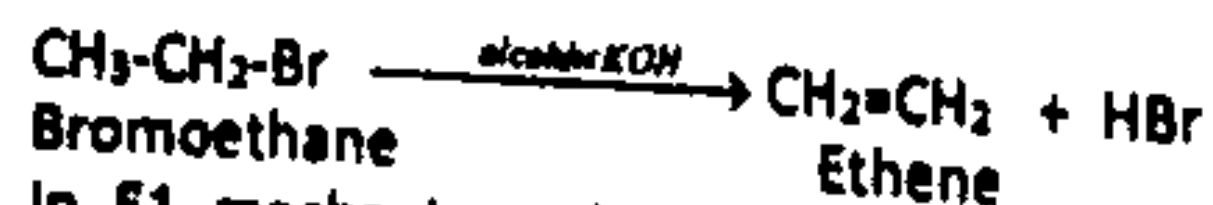
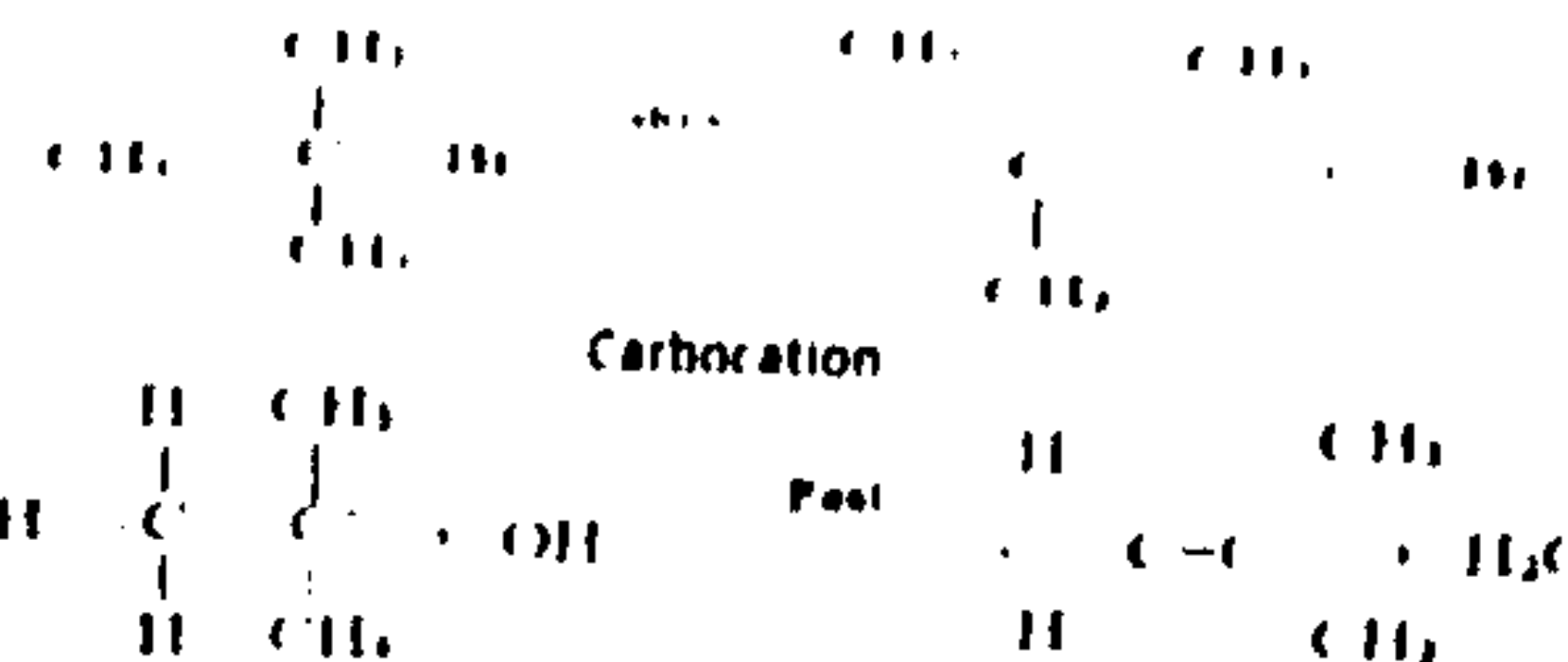
$CH_3-CH_2-Br \xrightarrow{alcoholic\ KOH} CH_2=CH_2 + HBr$

Bromoethane Ethene

Example: In E1 mechanism, the first step is the slow ionization of the substrate to give a carbocation. In the second step, the nucleophile attacks on hydrogen to give an alkene as a product.

$CH_3-C(CH_3)_2-Br \xrightarrow{slow} (CH_3)_3C^+ + Br^-$

Carbocation

$H-CH_2-C^+(CH_3)_2 + OH^- \xrightarrow{Fast} H_2C=C(CH_3)_2 + H_2O$

27. How will you convert CH_3-CH_3 to $(CH_3-CH_2)_4N^+Br^-$? (2times)

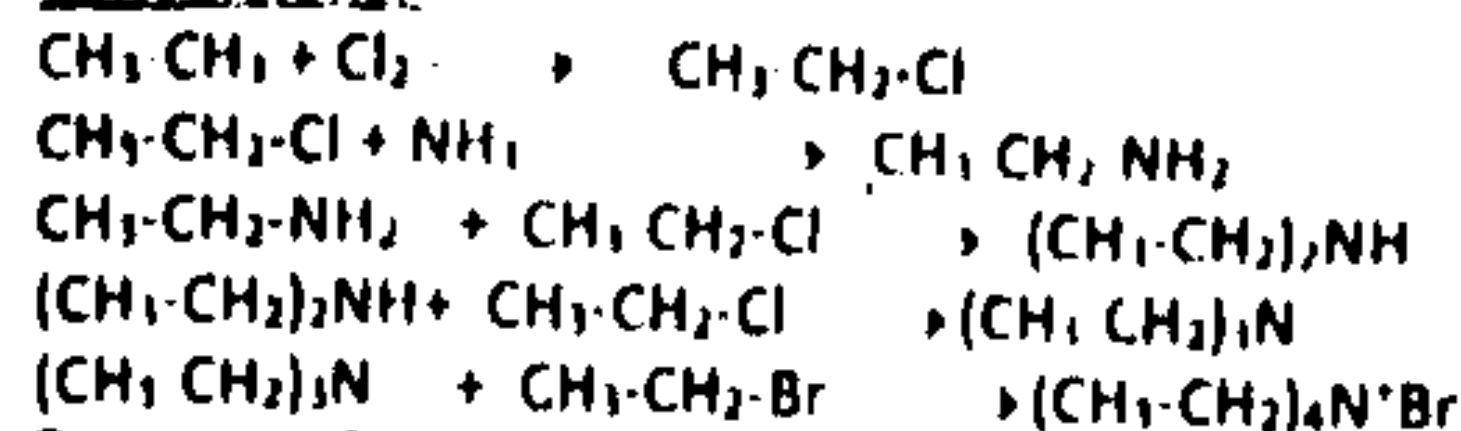
Ans: Conversions:-

$CH_3-CH_3 + Cl_2 \longrightarrow CH_3-CH_2-Cl$

$CH_3-CH_2-Cl + NH_3 \longrightarrow CH_3-CH_2-NH_2$

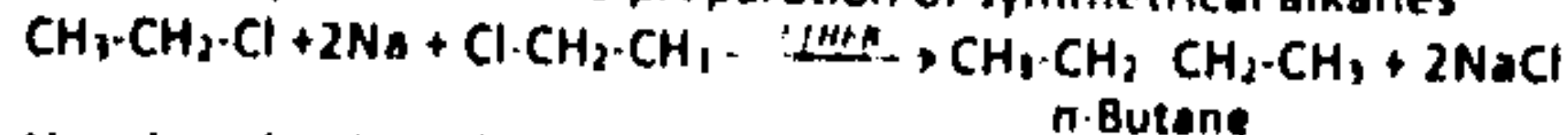
$CH_3-CH_2-NH_2 + CH_3-CH_2-Cl \longrightarrow (CH_3-CH_2)_2NH$

$(CH_3-CH_2)_2NH + CH_3-CH_2-Cl \longrightarrow (CH_3-CH_2)_3N$

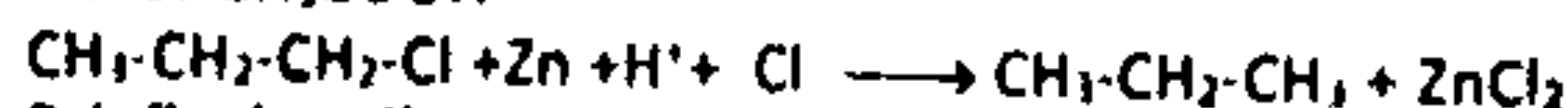
$(CH_3-CH_2)_3N + CH_3-CH_2-Br \longrightarrow (CH_3-CH_2)_4N^+Br^-$

28. Prepare n-Butane by Wurtz's reactions?

Ans: Alkyl halides react with sodium in ether solvent to give alkanes. The reaction is particularly useful for the preparation of symmetrical alkanes

$CH_3-CH_2-Cl + 2Na + Cl-CH_2-CH_3 \xrightarrow{Ether} CH_3-CH_2-CH_2-CH_3 + 2NaCl$

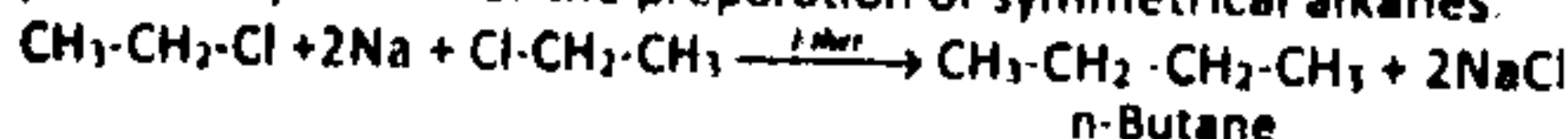
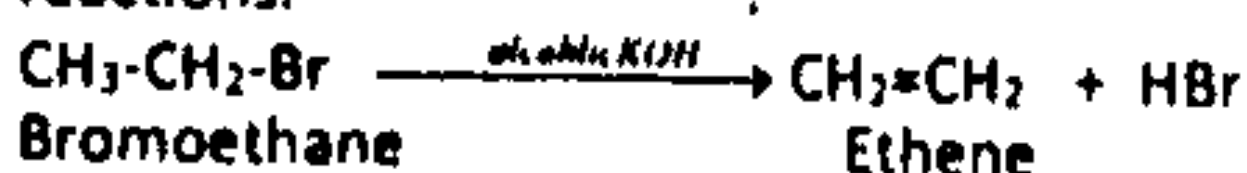
n-Butane

29. How is reduction of 1-chloropropane done to prepare propane?

Ans: Alkyl halides can be reduced with zinc in the presence of an aqueous acid such as HCl or CH_3COOH

$CH_3-CH_2-CH_2-Cl + Zn + H^+ + Cl^- \longrightarrow CH_3-CH_2-CH_3 + ZnCl_2$

30. Briefly describe "Wurtz synthesis"? (2 times)

Ans: Alkyl halides react with sodium in ether solvent to give alkanes. The reaction is particularly useful for the preparation of symmetrical alkanes.

$CH_3-CH_2-Cl + 2Na + Cl-CH_2-CH_3 \xrightarrow{Ether} CH_3-CH_2-CH_2-CH_3 + 2NaCl$

n-Butane

31. What are β-Elimination reactions? (3 times)

Ans: When nucleophile attacks on hydrogen atom attached to the β-carbon of the alkyl halide, we get an alkene, such type of reactions are called elimination reactions.

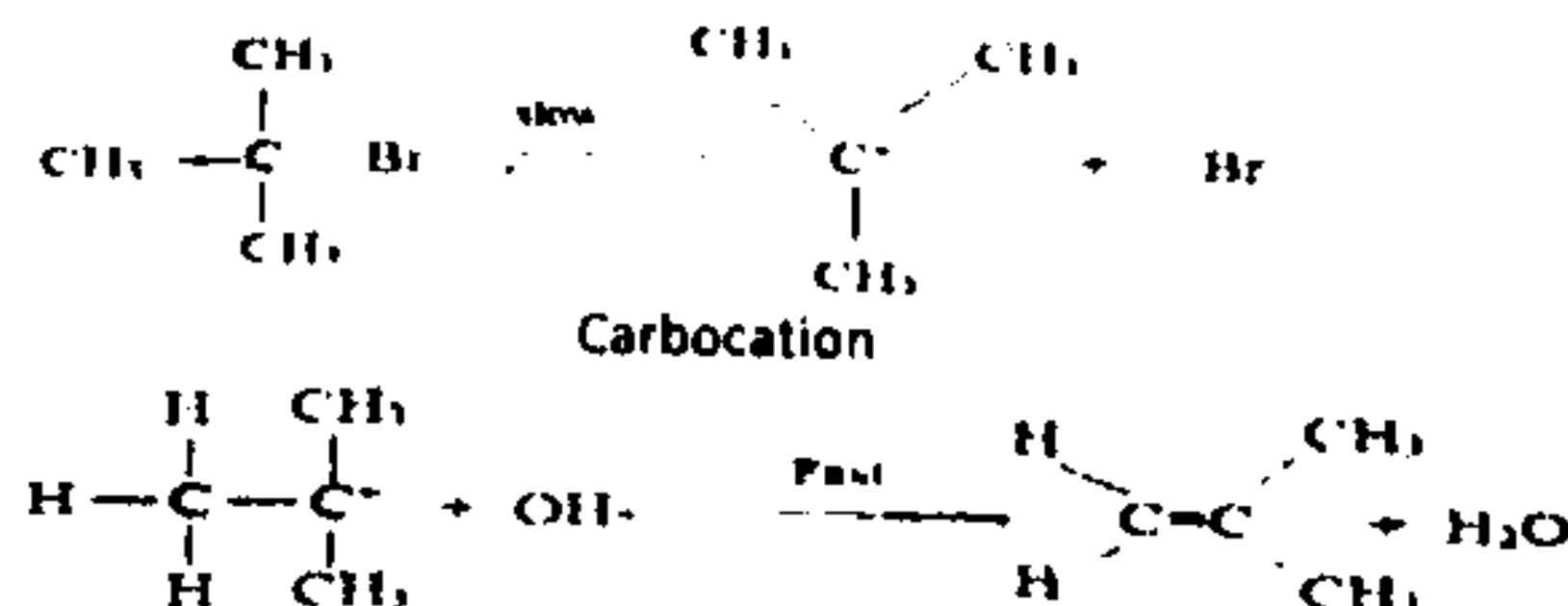
$CH_3-CH_2-Br \xrightarrow{alcoholic\ KOH} CH_2=CH_2 + HBr$

Bromoethane Ethene

Example: In E1 mechanism, the first step is the slow ionization of the substrate to give a carbocation. In the second step, the nucleophile attacks on hydrogen to give an alkene as a product.

$CH_3-C(CH_3)_2-Br \xrightarrow{slow} (CH_3)_3C^+ + Br^-$

Carbocation

$H-CH_2-C^+(CH_3)_2 + OH^- \xrightarrow{Fast} H_2C=C(CH_3)_2 + H_2O$

32. Convert ethyl bromide into quaternary ethyl ammonium bromide.

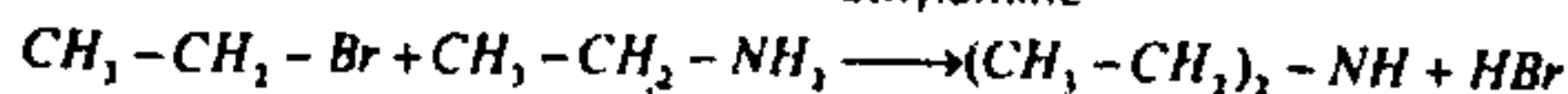
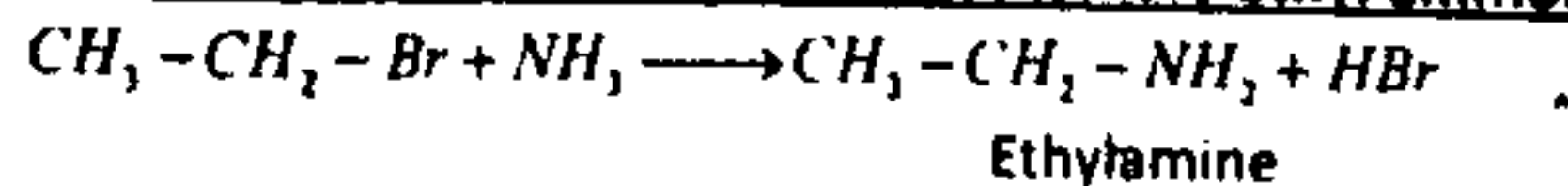
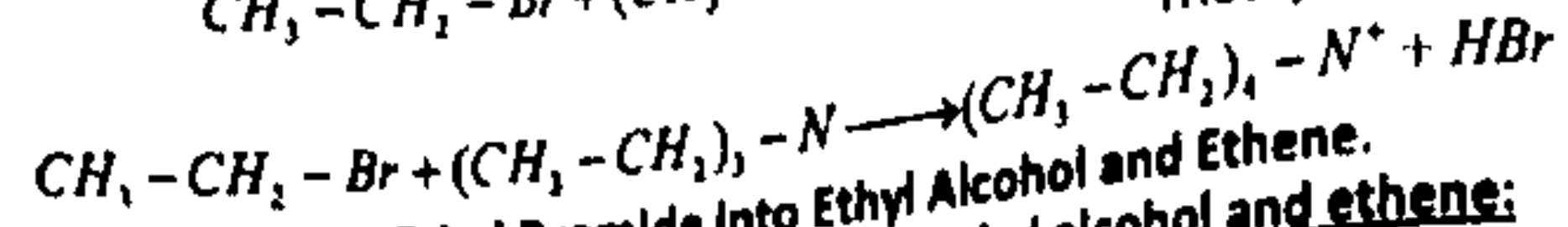
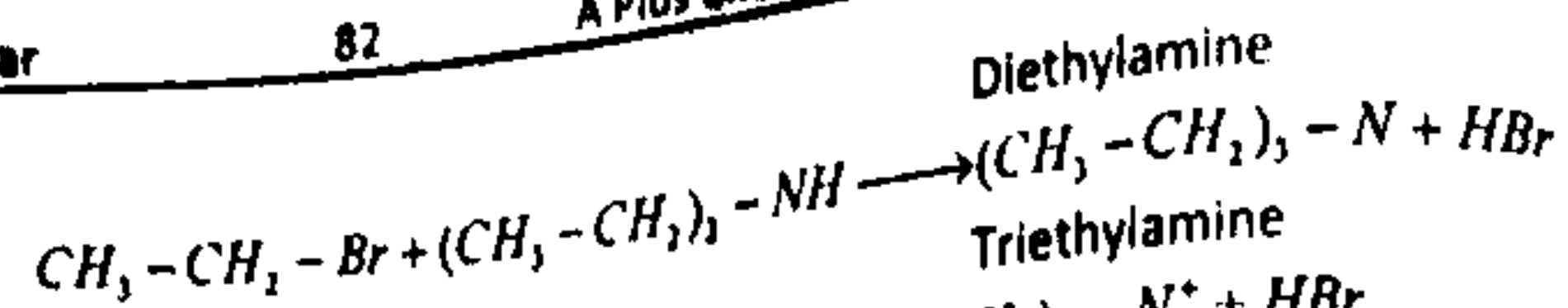
Ans: Conversion of ethyl bromide into quaternary ethyl ammonium bromide:

$CH_3-CH_2-Br + NH_3 \longrightarrow CH_3-CH_2-NH_2 + HBr$

Ethylamine

$CH_3-CH_2-Br + CH_3-CH_2-NH_2 \longrightarrow (CH_3-CH_2)_2-NH + HBr$

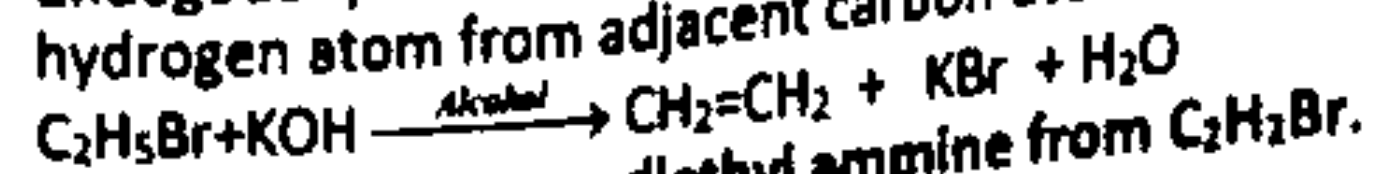
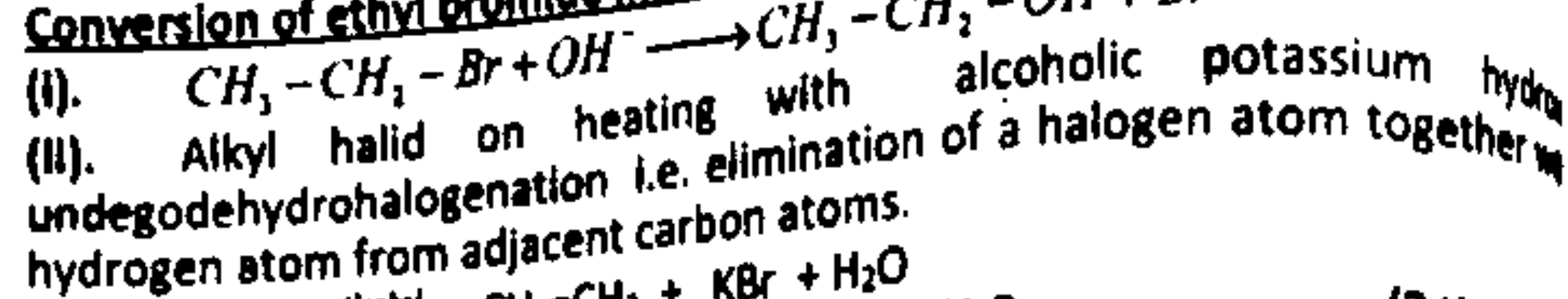
$$CH_3-CH_2-Br+(CH_3-CH_2)_2-NH \longrightarrow (CH_3-CH_2)_3-N+HBr$$
Triethylamine

$$CH_3-CH_2-Br+(CH_3-CH_2)_3-N \longrightarrow (CH_3-CH_2)_4-N^+ +HBr$$

33. Convert Ethyl Bromide into Ethyl Alcohol and Ethene.

Ans: **Conversion of ethyl bromide into ethyl alcohol and ethene:**

(i). $CH_3-CH_2-Br+OH^- \longrightarrow CH_3-CH_2-OH+Br^-$

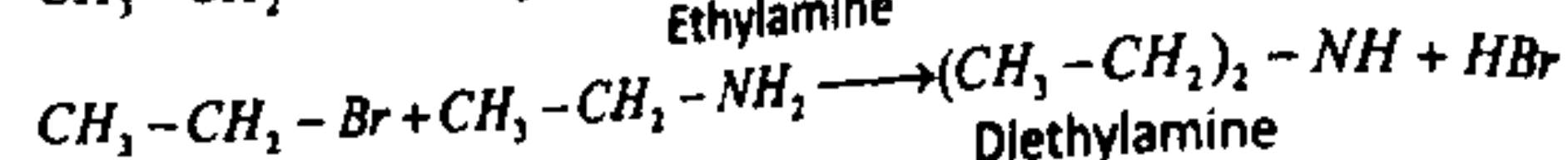
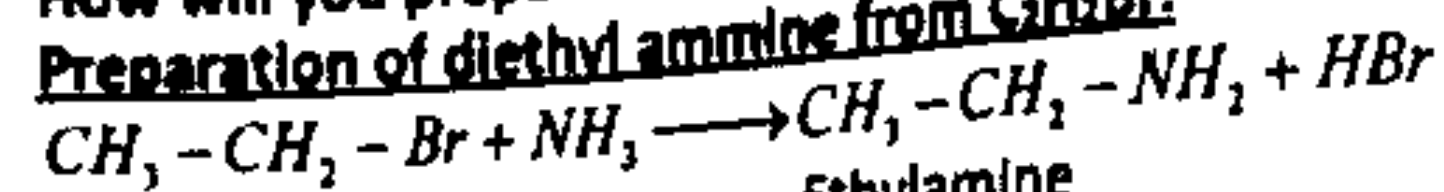
(ii). Alkyl halid on heating with alcoholic potassium hydroxide undegodehydrohalogenation i.e. elimination of a halogen atom together with hydrogen atom from adjacent carbon atoms.

$C_2H_5Br+KOH \xrightarrow{Alcohol} CH_2=CH_2 + KBr + H_2O$

34. How will you prepare diethyl ammine from C_2H_5Br. **(2 times)**

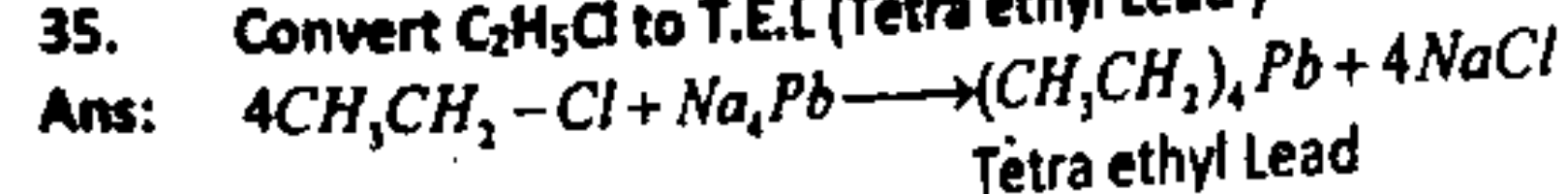
Ans: **Preparation of diethyl ammine from C_2H_5Br:**

$$CH_3-CH_2-Br+NH_3 \longrightarrow CH_3-CH_2-NH_2+HBr$$
Ethylamine

$$CH_3-CH_2-Br+CH_3-CH_2-NH_2 \longrightarrow (CH_3-CH_2)_2-NH+HBr$$
Diethylamine

Quaternary ethylamine

35. Convert C_2H_5Cl to T.E.L (Tetra ethyl Lead)

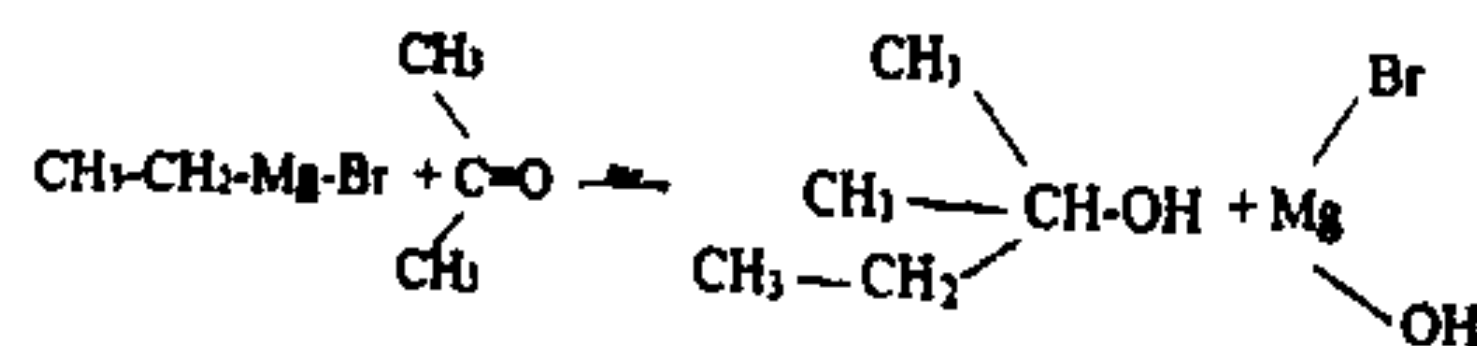
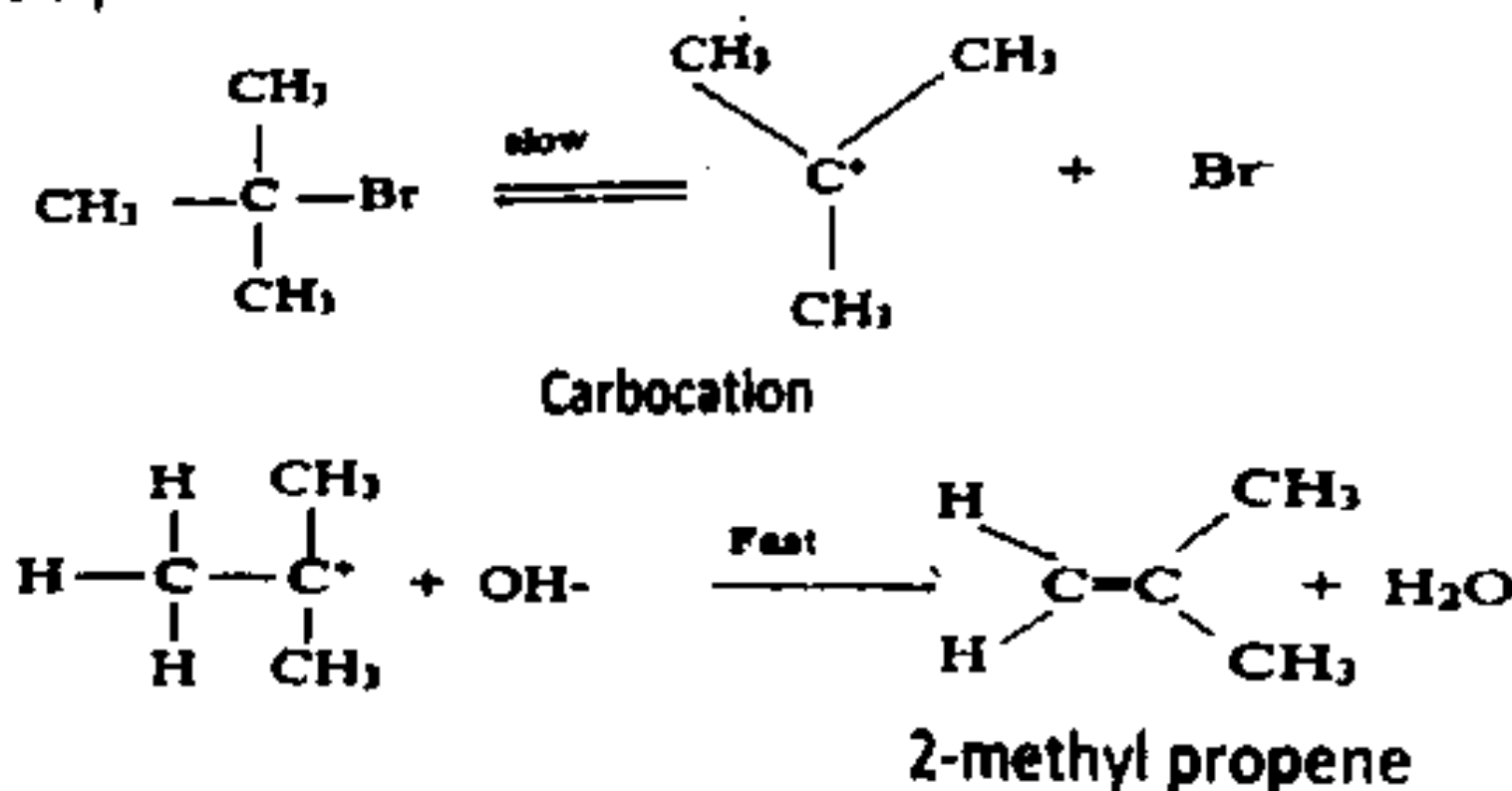
Ans: $4CH_3CH_2-Cl+Na_4Pb \longrightarrow (CH_3CH_2)_4Pb+4NaCl$

Tetra ethyl Lead

36. Give mechanism of E_1 elimination reaction in two steps.

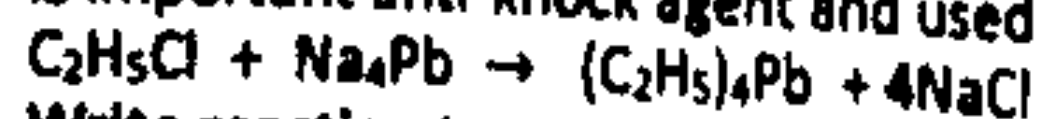
Ans: In E1 mechanism, the first step is the slow ionization of the substrate to give carbocation. In the second step, the nucleophile attacks on hydrogen to give alkene as a product.

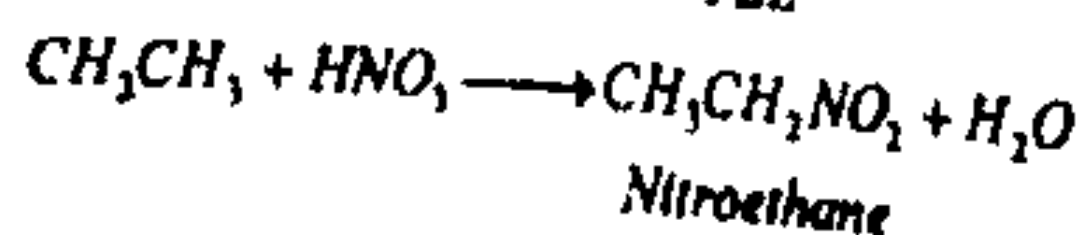
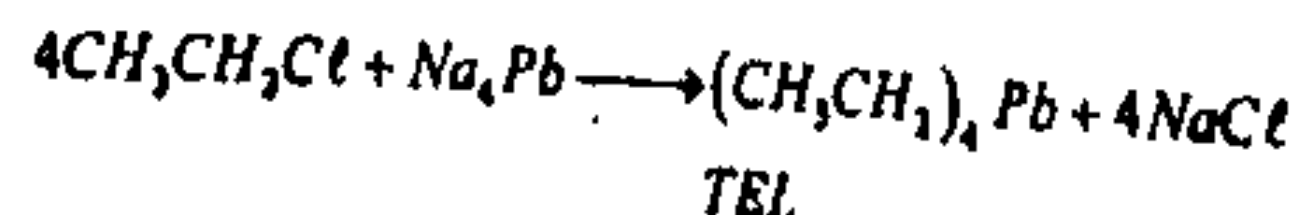
$$(CH_3)_3C-Br \xrightleftharpoons{slow} (CH_3)_3C^+ + Br^-$$
Carbocation

$$H-CH_2-C^+(CH_3)_2 + OH^- \xrightarrow{Fast} H_2C=C(CH_3)_2 + H_2O$$
2-methyl propene

$$CH_3-CH_2-Mg-Br + (CH_3)_2C=O \longrightarrow (CH_3)_2(CH_3-CH_2)C-OH + Mg(Br)OH$$

37. Convert C_2H_5Cl to T.E.L.

Ans: Ethyl chloride react with sodium lead alloy giving tetraethyl lead. This compound is important anti-knock agent and used in gasoline.

$C_2H_5Cl + Na_4Pb \rightarrow (C_2H_5)_4Pb + 4NaCl$

38. Write reaction to propane tetraethyl lead and nitroethane

Ans:

$$4CH_3CH_2Cl+Na_4Pb \longrightarrow (CH_3CH_2)_4Pb+4NaCl$$
TEL

$$CH_3CH_3+HNO_3 \longrightarrow CH_3CH_2NO_2+H_2O$$
Nitroethane

LONG QUESTIONS OF CHAPTER-10
ALKYL HALIDES
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 10.1

1. Define Alkyl Halide. Give three methods to prepare them from Alcohols. **(2 times)**

Ans: (Text Book Page No:197)

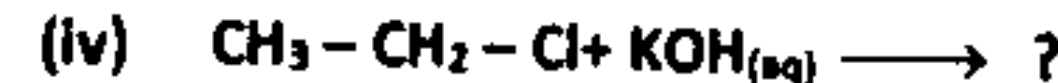
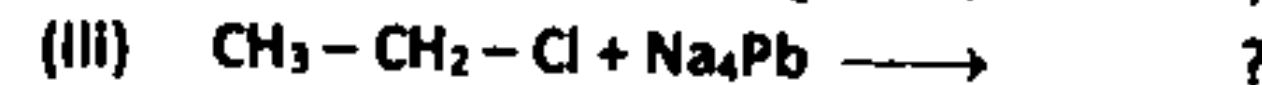
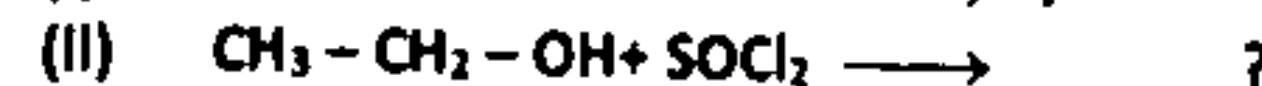
Topic No: 10.3

2. Complete the following chemical reactions.

(i) $CH_3-CH_2-Cl+Na \longrightarrow ?$

(ii) $CH_3-CH_2-OH+SOCl_2 \longrightarrow ?$

(iii) $CH_3-CH_2-Cl+Na_4Pb \longrightarrow ?$

(iv) $CH_3-CH_2-Cl+KOH_{(aq)} \longrightarrow ?$

Topic No: 10.5.1

3. Write note on the following terms and give an example in each case. (2 times)

i) Nucleophile ii) Electrophile iii) Leaving group iv) Substrate

Ans: (Text Book Page No:199)

4. What are SN-reactions? Explain SN[1] reaction in detail.

Ans: (Text Book Page No:200)

Topic No: 10.5.2

5. What are S_N reaction? Differentiate between S_N1 and S_N2 reaction? **(6 times)**

Ans: (Text Book Page No:198)

6. Discuss S_N2 reactions of alkyl halides in detail. **(7 times)**

Ans: (Text Book Page No:200)

7. Write a note on S_N1 reactions.

Ans: (Text Book Page No:200)

8. Define Nucleophilic substitution reactions and discuss the mechanism of S_N1 reaction. **(7 times)**

Ans: (Text Book Page No:198+200)

9 What are S_N reactions & Explain S_N1 reactions with help of suitable example.

Ans: (Text Book Page No:200)

Topic No: 10.5.3

10. Write a note on β-elimination reactions. **(2 times)**

Ans: (Text Book Page No:202)

11. Using ethyl bromide as a starting material how would you prepare :

n-Butane b) Ethene

Ans: (Text Book Page No:204)

12. Using ethyl bromine how would you prepare **(2 times)**

N-butane ii) Etheneiii) Ethyl Alcohol iv) Propanoicacid

Ans: (Text Book Page No:204)

13. Discuss briefly the two possible mechanisms of β-elimination reactions.

Ans: (Text Book Page No:202)

14. Define elimination reactions and discuss the mechanism of E_2 reactions. **(4 times)**

Ans: (Text Book Page No:202)

15. Compare E2 and E1 mechanism for the β-Elimination reactions?

Ans: (Text Book Page No:202)

16. Write down reaction of CH_3-CH_2-Cl with (i) Na (ii) Zn + HCl (iii) Na_4Pb(iv) Mg

Ans: (Text Book Page No:204)

OBJECTIVES (MCQ'S) OF CHAPTER- 11 ALCOHOLS, PHENOLS AND ETHER ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 11.1

1. Which compound is called universal solvent? (5 times)
(a) H_2O (b) CH_3OH (c) C_2H_5OH (d) $CH_3—O-CH_3$

Topic No: 11.2

2. ________ is alcohol in the following: (3 times)
(a) CH_3CH_2OH (b) CH_3OCH_3 (c) CH_3COOH (d) CH_3CHO

Topic No: 11.2.2

3. Alcohol obtained by fermentation is only upto: (3 times)
(a) 10% (b) 12% (c) 20% (d) 95%

4. Rectified spirit contains alcohol (ethanol) about: (5 times)
(a) 80% (b) 85% (c) 90% (d) 95%

5. Which enzyme is not used in fermentation of starch? (7 times)
(a) Urease (b) Diastase (c) Zymase (d) Invertase

6. Methyl alcohol is not used : (2 times)
(a) As a solvent (b) As a antifreezing agent
(c) As a substitute for petrol (d) For denaturing of ethyl alcohol

Topic No: 11.2.3

7. The compound which is more soluble in water: (5 times)
(a) C_6H_5OH (b) C_2H_5OH (c) $C_6H_{13}OH$ (d) $C_7H_{15}OH$

8. Which compound shows hydrogen bonding?
(a) C_2H_6 (b) C_2H_5COOH (c) C_2HO_5H (d) C_2H_5OH

9. ________ compound shows extensive Hydrogen Bonding with water:
(a) C_2H_6 (b) H_2S (c) CH_3Cl (d) C_2H_5OH

Topic No: 11.2.4

10. In t-butyl alcohol, the tertiary carbon is bonded to: (7 times)
(a) Three hydrogen atoms (b) Two hydrogen atoms
(c) One hydrogen atom (d) No hydrogen atom

11. Ethanol can be converted into ethanoic acid by: (9 times)
(a) Oxidation (b) Fermentation (c) Hydrogenation (d) Hydration

Topic No: 11.2.7

12. Isopropyl alcohol on oxidation gives:
(a) acetaldehyde (b) acetone (c) ether (d) propene

Topic No: 11.5

13. Carbolic acid is:
(a) Phenol (b) Methanol (c) Carbonic acid (d) Chloroform

Topic No: 11.5.6

14. Phenol can be identified by the test:
(a) Bromine water (b) Chlorine water (c) Lucas test (d) Bayers test

Topic No: 11.6.3

15. Which of the following shows maximum hydrogen bonding with water? (8 times)
(a) CH_3OH (b) C_2H_5OH (c) $CH_3—O—CH_3$ (d) C_6H_5OH

16. Which of the following is weakest acid?
(a) Phenol (b) Benzoic acid (c) Ethyl alcohol (d) Water

17. Which compound causes maximum repulsion with water? (3 times)
(a) C_2H_5OH (b) C_6H_6 (c) CH_3-O-CH_3 (d) $CH_3-CH_2-CH_2-OH$

18. Which of the following will have highest boiling point? (4 times)
(a) methanol (b) ethanol (c) propanol (d) 2-hexanone

2018

19. Alcohol obtained by fermentation process never exceed beyond:
(a) 14% (b) 10% (c) 16% (d) 95%

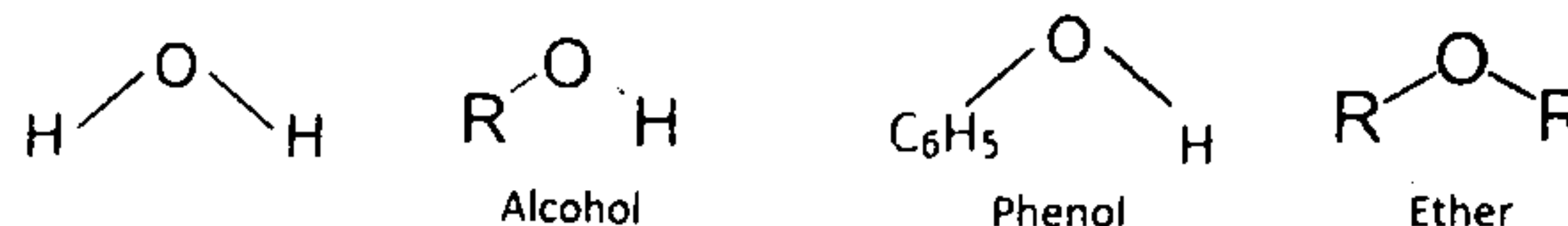
ANSWERS TO MULTIPLE CHOICE QUESTIONS:

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
A	A	B	D	A	C	B	D	D	D	A	B	A	A	B	C	B	D	A

SHORT QUESTIONS OF CHAPTER- 11 ALCOHOLS, PHENOLS AND ETHER ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 11.1

1. Why are alcohols, phenols and ethers considered as derivatives of water.

Alcohol Phenol Ether

Ans: Alcohols, phenols and ethers are close in structure to water so therefore considered as derivatives of water.

Topic No: 11.2

2 Differentiate between primary and secondary alcohol?

Ans: Monohydric alcohols are further classified into primary, secondary and tertiary alcohols. In primary alcohols –OH group is attached with primary carbon atom, in secondary alcohols –OH group is attached with secondary carbon atom. For example

CH_3-CH_2-OH — Primary alcohol

$(CH_3)_2CH-OH$ — Secondary alcohol

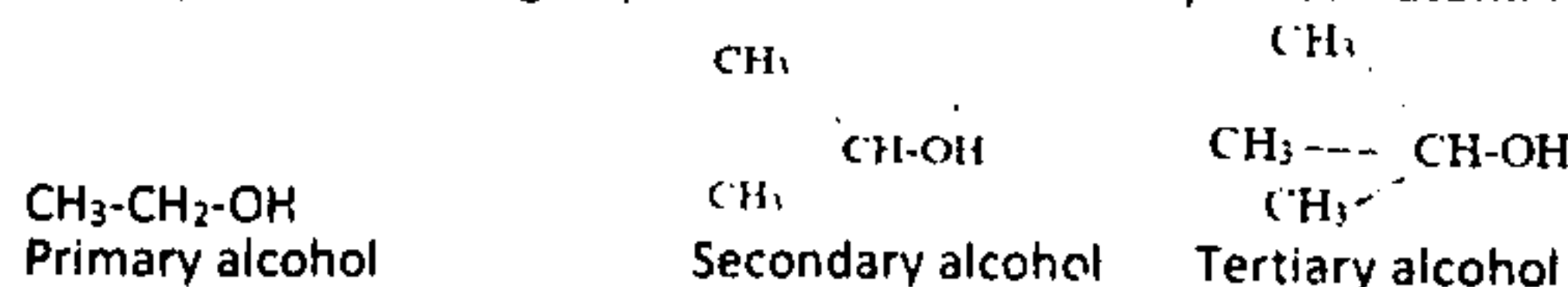
3 Classify alcohols giving an example for each?

Ans: Alcohols are classified into monohydric and polyhydric alcohols. Monohydric alcohols contain one –OH group while polyhydric alcohols contain two, three or more –OH groups and named as dihydric or trihydric etc.

Monohydric alcohols are further classified into primary, secondary and tertiary alcohols. In primary alcohols –OH group is attached with primary carbon atom, in secondary alcohols –OH group is attached with secondary carbon atom and in tertiary alcohols –OH group is attached with tertiary carbon atom. For example

CH_3-CH_2-OH — Primary alcohol

$(CH_3)_2CH-OH$ — Secondary alcohol

$(CH_3)_3C-OH$ — Tertiary alcohol

4 Define and give examples of each of Dihydric and Trihydric Alcohols? (3 times)

Ans: Alcohols are classified into monohydric and polyhydric alcohols. Monohydric alcohols contain one –OH group while polyhydric alcohols contain two, three or more –OH groups and named as dihydric or trihydric etc. For example:

Dihydric: $CH_2(OH)-CH_2(OH)$ — 1,2Ethanediol

Trihydric: $CH_2(OH)-CH(OH)-CH_2(OH)$ — 1,2,3-propanetriol

5 Why ethyl alcohol is liquid while Ethyl chloride is gas at room temperature? (4 times)

Ans: Ethyl alcohol is liquid while ethyl chloride is gas because ethyl alcohol has hydrogen bonding which is present in it but absent in ethyl chloride.

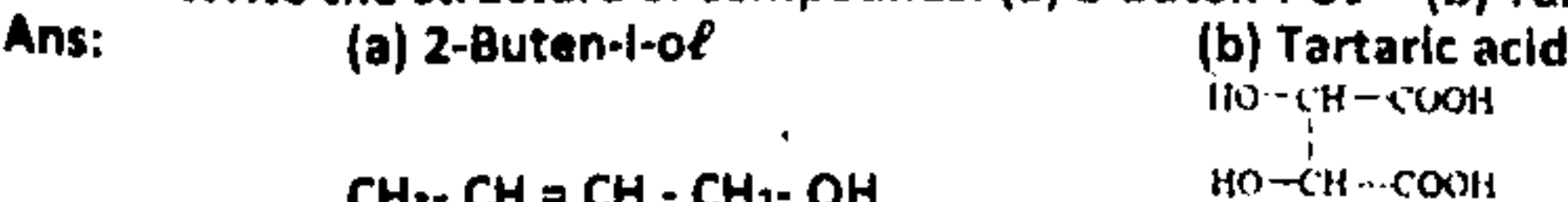
6 Write the structure of compounds: (a) 2-Buten-l-oℓ (b) Tartaric acid

Ans:

(a) 2-Buten-l-oℓ

$CH_3-CH=CH-CH_2-OH$

(b) Tartaric acid

$HO-CH-COOH$
$HO-CH-COOH$

7. Give classification of monohydric alcohols with examples.

Ans: Monohydric alcohols are classified into primary, secondary and tertiary alcohol

CH_3-CH_2-OH *Primary alcohol*

$$CH_3-\underset{}{\overset{CH_3}{\overset{|}{C}}}H-OH$$ *Secondary alcohol*

$$CH_3-\overset{CH_3}{\overset{|}{\underset{\underset{CH_3}{|}}{C}}}-OH$$ *Tertiary alcohol*

8. Prepare ethanol from starch.

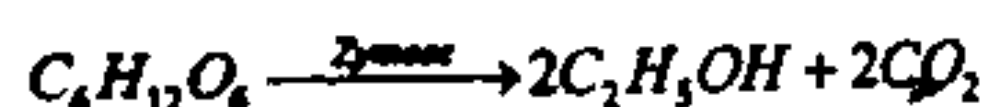
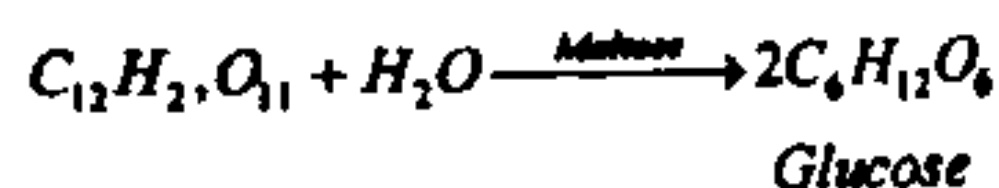
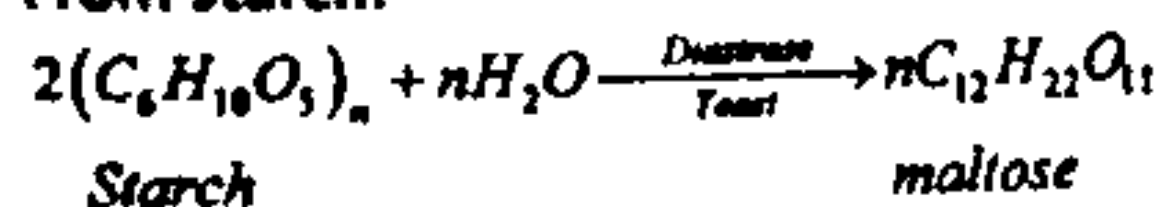
Ans: From starch:

$$2(C_6H_{10}O_5)_n + nH_2O \xrightarrow[Yeast]{Diastase} nC_{12}H_{22}O_{11}$$

Starch *maltose*

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{Maltase} 2C_6H_{12}O_6$$

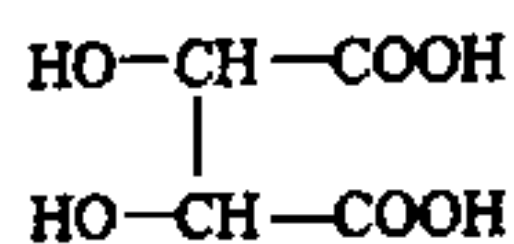
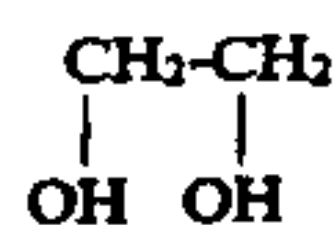
Glucose

$$C_6H_{12}O_6 \xrightarrow{Zymase} 2C_2H_5OH + 2CO_2$$

Topic No: 11.2.1

9 Give structural formula of 1,2-ehanediol and tartaric acid.

Ans: 1,2-ehanediol **tartaric acid**

$$\underset{OH}{\underset{|}{CH_2}}-\underset{OH}{\underset{|}{CH_2}}$$

$$\begin{matrix} HO-CH-COOH \\ | \\ HO-CH-COOH \end{matrix}$$

10. Write down structural formula of following compounds.

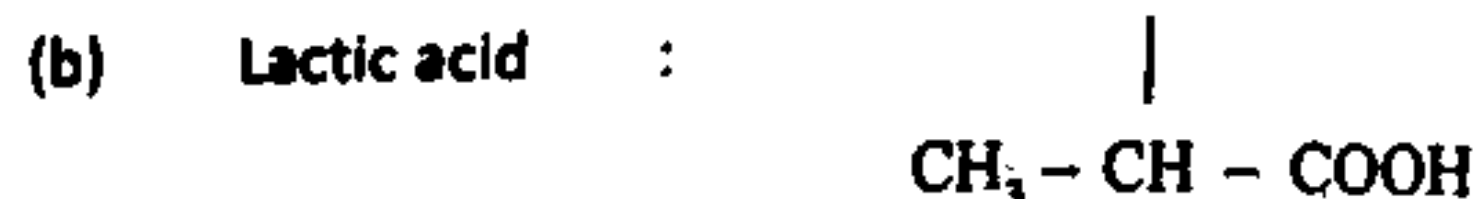
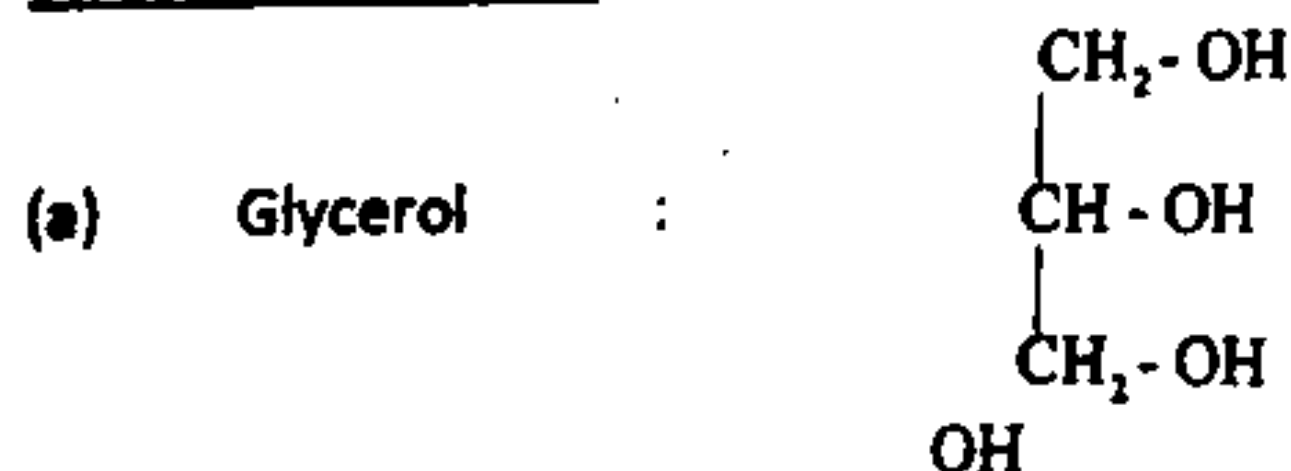
(a) Glycerol (b) Lactic acid

Ans: <u>Structural formulae</u>

(a) Glycerol :

$$\begin{matrix} CH_2-OH \\ | \\ CH-OH \\ | \\ CH_2-OH \end{matrix}$$

(b) Lactic acid :

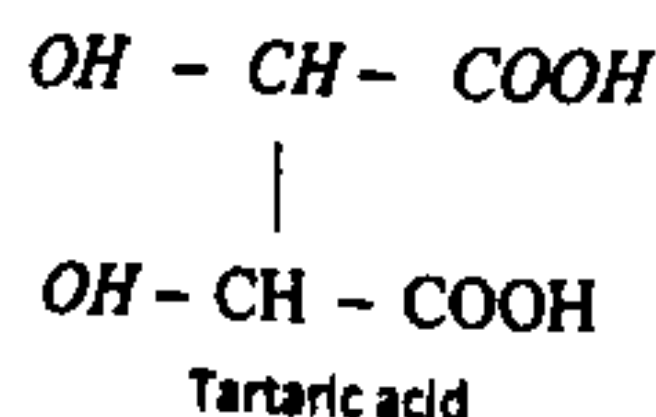
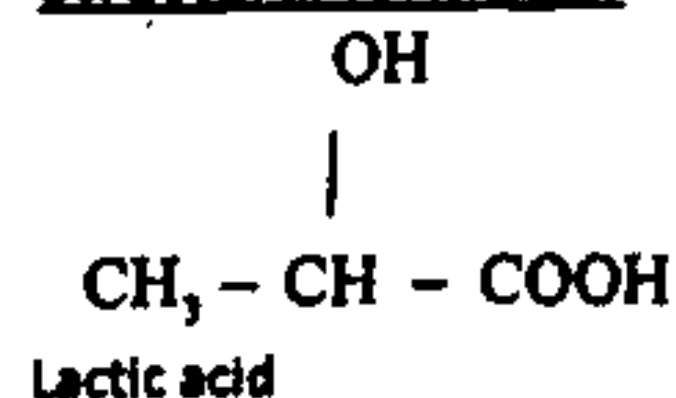
$$CH_3-\overset{OH}{\overset{|}{C}}H-COOH$$

11. Write structural formula of lactic acid and tartaric acid?

Ans: <u>Structural formulae:</u>

$$CH_3-\overset{OH}{\overset{|}{C}}H-COOH$$

Lactic acid

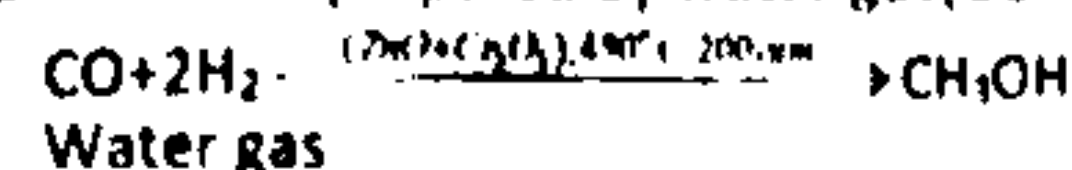
$$\begin{matrix} OH-CH-COOH \\ | \\ OH-CH-COOH \end{matrix}$$

Tartaric acid

Topic No: 11.2.2

12 Give preparation of methanol by reaction of CO and H_2?

Ans: Methanol can be prepared by water gas($CO+H_2$) as:

$$CO+2H_2 \xrightarrow{(ZnO+Cr_2O_3),\ 450^\circ C,\ 200\,atm} CH_3OH$$

Water gas

First of all mixture of carbon monoxide and hydrogen is purified. It is compressed under a pressure of 200 atmospheres and taken into a reaction chamber by means of coiled pipes. Here the catalyst is heated upto 450-500ºC. Gases react to form methanol vapours. These vapours are passed through a condenser to get methanol. Unreacted gases are recycled though compressor to reaction chamber.

13 How is methylated spirit prepared?

Ans: Ethanol is denatured by addition of 10% methanol to avoid its use for drinking purposes. Such alcohol is called methylated spirit. A small quantity of pyridine or acetone may also be added for this purpose.

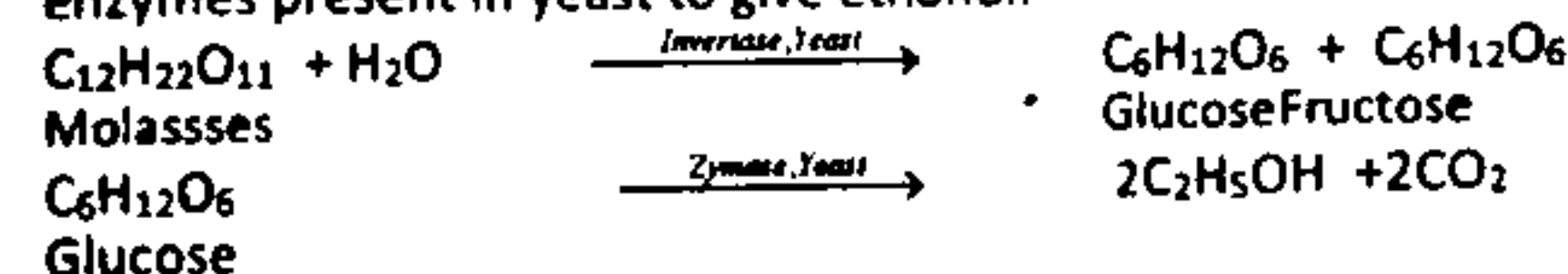
14 Only 12-14% ethanol can be prepared by fermentation process.Justify?

Ans: Alcohol obtained by fermentation is only upto12% and never exceeds 14% because beyond this limit enzymes become inactive. This alcohol is distilled again and again to obtain 95% alcohol which is called rectified spirit.

15 Write the equations involved in preparation of ethyl alcohol from molasses?

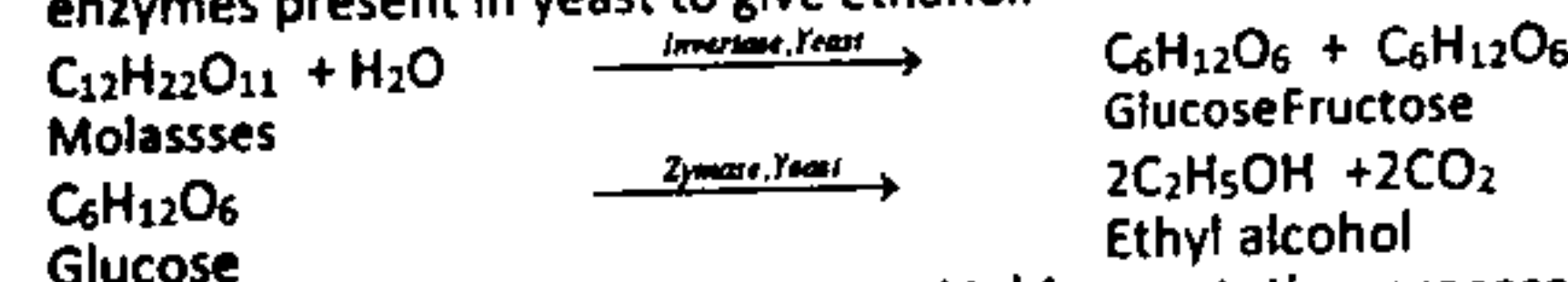
Ans: The residue obtained after the crystallization of sugar from concentrated sugar cane juice is called molasses. It undergoes fermentation in the presence of enzymes present in yeast to give ethanol.

$$\underset{Molassses}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{Invertase,Yeast} \underset{Glucose}{C_6H_{12}O_6} + \underset{Fructose}{C_6H_{12}O_6}$$

$$\underset{Glucose}{C_6H_{12}O_6} \xrightarrow{Zymase,Yeast} 2C_2H_5OH + 2CO_2$$

16 How ethanol is prepared from Molasses?

Ans: The residue obtained after the crystallization of sugar from concentrated sugar cane juice is called molasses. It undergoes fermentation in the presence of enzymes present in yeast to give ethanol.

$$\underset{Molassses}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{Invertase,Yeast} \underset{Glucose}{C_6H_{12}O_6} + \underset{Fructose}{C_6H_{12}O_6}$$

$$\underset{Glucose}{C_6H_{12}O_6} \xrightarrow{Zymase,Yeast} \underset{Ethyl\ alcohol}{2C_2H_5OH} + 2CO_2$$

17 Absolute alcohol cannot be prepared by fermentation process. Why? (6 times)

Ans: Absolute alcohol cannot be prepared by fermentation process because there if moisture in the process. Absolute alcohol can be prepared by the rectified spirit in the presence of CaO which absorb its moisture.

18 Define fermentation. Give one example? (2 times)

Ans: <u>**Fermentation:-**</u>Fermentation is a biochemical process which occurs in presence of certain enzymes secreted by microorganisms such as yeast. Optimum temperature for this process of fermentation is 25-35ºC. Proper aeration, dilution of solution and the absence of any preservative are essential conditions for fermentation.

19 Explain denaturing of alcohol? (7 times)

Ans: Ethanol is denatured by addition of 10% methanol to avoid its use for drinking purposes. Such alcohol is called methylated spirit. A small quantity of pyridine or acetone may also be added for this purpose.

20 How ethanol is prepared on industrial scale in the world?

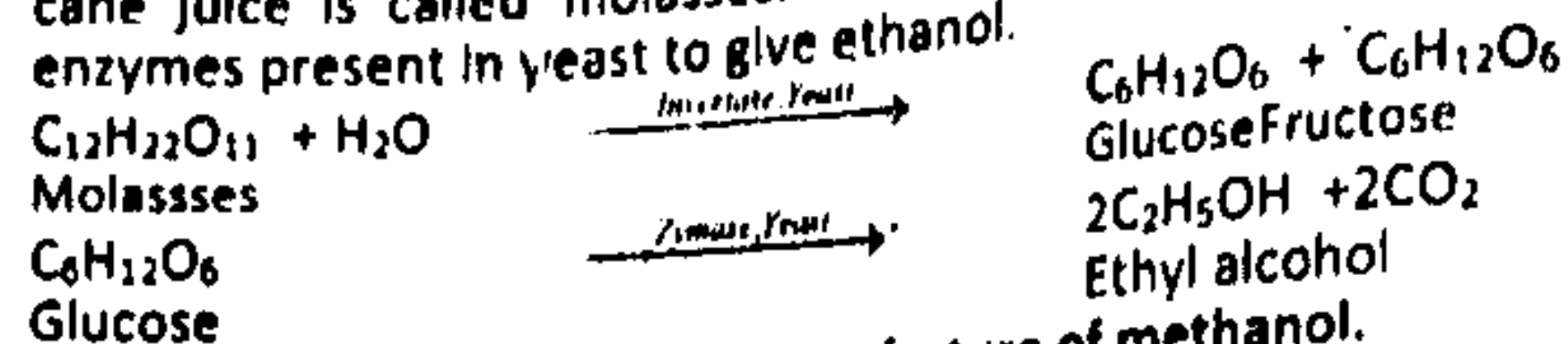
Ans: Ethanol is prepared on industrial scale world over by the process of fermentation. Fermentation is a biochemical process which occurs in the presence of certain enzymes secreted by microorganisms such as yeast. Optimum temperature for this process of fermentation is 25-35ºC. Proper aeration, dilution of solution and the absence of any preservative are essential conditions for fermentation.

The residue obtained after the crystallization of sugar from concentrated sugar cane juice is called molasses. It undergoes fermentation in the presence of enzymes present in yeast to give ethanol.

$C_{12}H_{22}O_{11} + H_2O \xrightarrow{Invertase\ Yeast} C_6H_{12}O_6 + C_6H_{12}O_6$

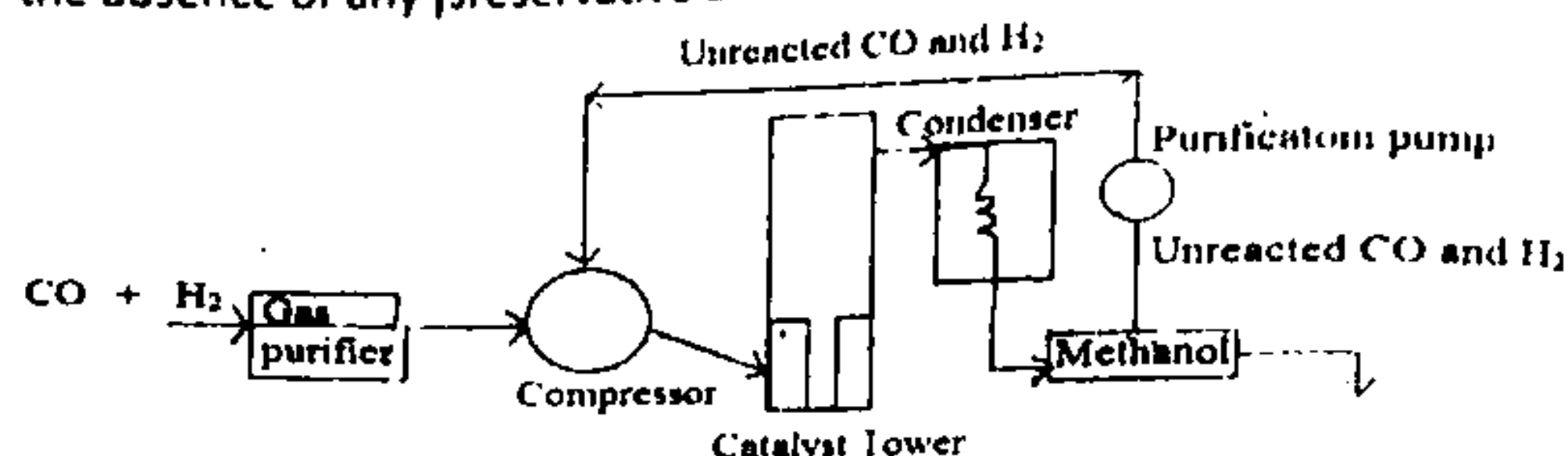
Molassses — Glucose Fructose

$C_6H_{12}O_6 \xrightarrow{Zymase\ Yeast} 2C_2H_5OH + 2CO_2$

Glucose — Ethyl alcohol

21. Draw flow sheet diagram for manufacture of methanol.

Ans: **Flow sheet diagram for manufacture of methanol:**

22 What are the essential conditions for fermentations?

Ans: Fermentation is a biochemical process which occurs in presence of certain enzymes secreted by microorganisms such as yeast. Optimum temperature for this process of fermentation is 25-35°C. Proper aeration, dilution of solution and the absence of any preservative are essential conditions for fermentation.

23 Define fermentation?

Ans: **Fermentation:** Fermentation is a biochemical process which occurs in presence of certain enzymes secreted by microorganisms such as yeast. Optimum temperature for this process of fermentation is 25-35ºC. Proper aeration, dilution of solution and the absence of any preservative are essential conditions for fermentation.

24 How is alcohol denaturned to make it unfit for drinking?

Ans: Ethanol is denatured by addition of 10% methanol to avoid its use for drinking purposes. Such alcohol is called methylated spirit. A small quantity of pyridine or acetone may also be added for this purpose.

25. Define (a) Absolute alcohol (b) Rectified Spirit (c) Methylated spirit (d) Denaturing of alcohol

Ans: **(a) Absolute alcohol:**

99.9% pure alcohol is called absolute alcohol.

(b) Rectified spirit:

95% alcohol is called rectified spirit.

(c) Denaturing of alcohol:

Alcohol is denaturing by adding 10% methanol to avoid its drinking purpose.

(d) Methylated spirit:

Alcohol in which there is 10% methanol is called rectified spirit.

Topic No: 11.2.3

26. Water has higher boiling point than ethanol. Explain. (2 times)

Ans: Melting and boiling point of alcohol are higher than corresponding alkanes. Methyl alcohol and ethyl alcohol are liquids while methane and ethane are gases. This is also due to hydrogen bonding which is present in alcohols but absent in alkanes.

27. Ethanol has higher boiling point than diethyl ether. Give reason?

Ans: **Boiling Points:**

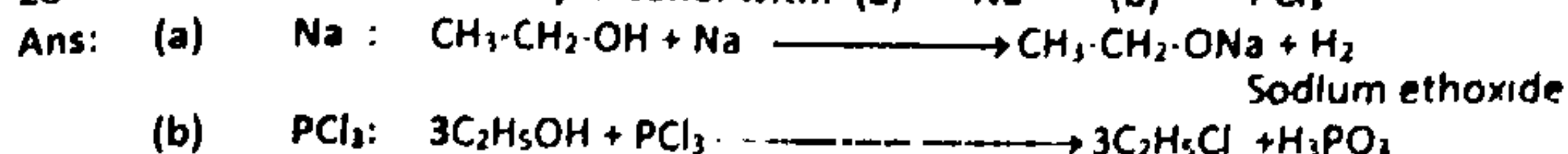
Ethanol has higher boiling point than diethyl ether because ethanol has strong hydrogen bonding present in molecules while ether don't show hydrogen bonding with in its molecules.

Topic No: 11.2.6

28 Give reactions of ethyl alcohol with: (a) Na (b) PCl_5

Ans: (a) Na : $CH_3\text{-}CH_2\text{-}OH + Na \longrightarrow CH_3\text{-}CH_2\text{-}ONa + H_2$

Sodium ethoxide

(b) PCl_3: $3C_2H_5OH + PCl_3 \longrightarrow 3C_2H_5Cl + H_3PO_3$

Topic No: 11.2.7

29 How does ethyl alcohol react with the following reagents?

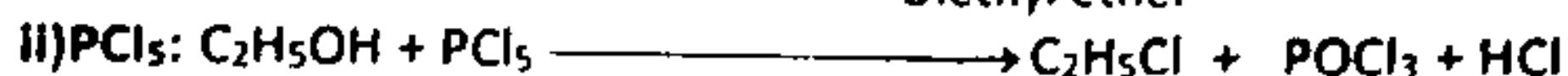
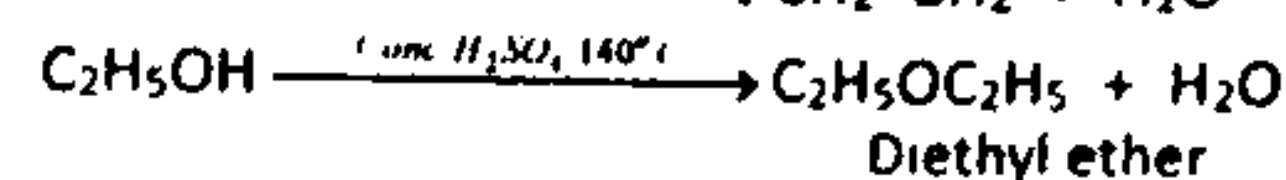
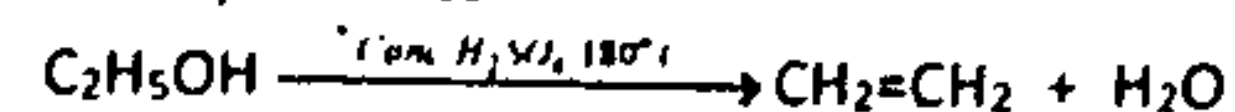
i)Conc.H_2SO_4 ii)PCl_5

Ans: i)Conc.H_2SO_4: Alcohol reacts with conc. H_2SO_4 and give different products at different temperatures.

$C_2H_5OH \xrightarrow{Conc\ H_2SO_4,\ 180°C} CH_2{=}CH_2 + H_2O$

$C_2H_5OH \xrightarrow{Conc\ H_2SO_4,\ 140°C} C_2H_5OC_2H_5 + H_2O$

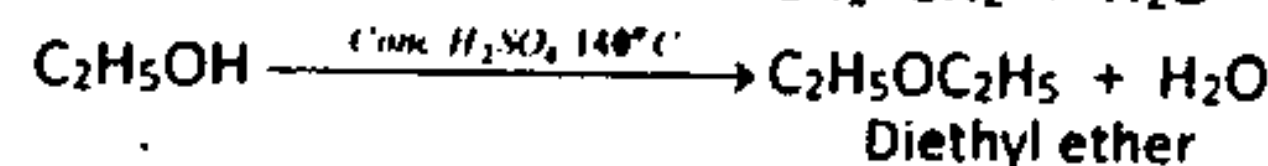
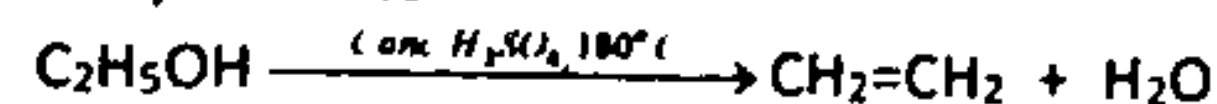
Diethyl ether

ii)PCl_5: $C_2H_5OH + PCl_5 \longrightarrow C_2H_5Cl + POCl_3 + HCl$

30 Alcohol react with conc.H_2SO_4 and give, different products at different conditions. Give reactions? (4 times)

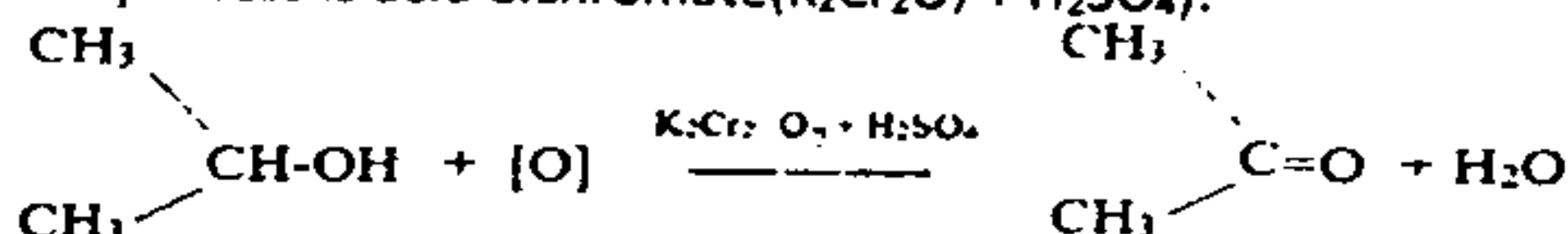
Ans: Alcohol reacts with conc. H_2SO_4 and give different products at different temperatures.

$C_2H_5OH \xrightarrow{Conc\ H_2SO_4,\ 180°C} CH_2{=}CH_2 + H_2O$

$C_2H_5OH \xrightarrow{Conc\ H_2SO_4,\ 140°C} C_2H_5OC_2H_5 + H_2O$

Diethyl ether

31 Convert 2-Propanol into acetone.?

Ans: 2-Propanol is converted into acetone by oxidation reaction. Oxidizing agents in this process is acid dichromate($K_2Cr_2O_7 + H_2SO_4$).

$(CH_3)_2CH\text{-}OH + [O] \xrightarrow{K_2Cr_2O_7 + H_2SO_4} (CH_3)_2C{=}O + H_2O$

32. How Ethyl Alcohol and Iso-Propyl Alcohols are oxidized?

Ans: Oxidation of alcohols convert them into aldehydes and ketones. The best reagent for these purpose is acid dichromate.

Eethyl alcohol:

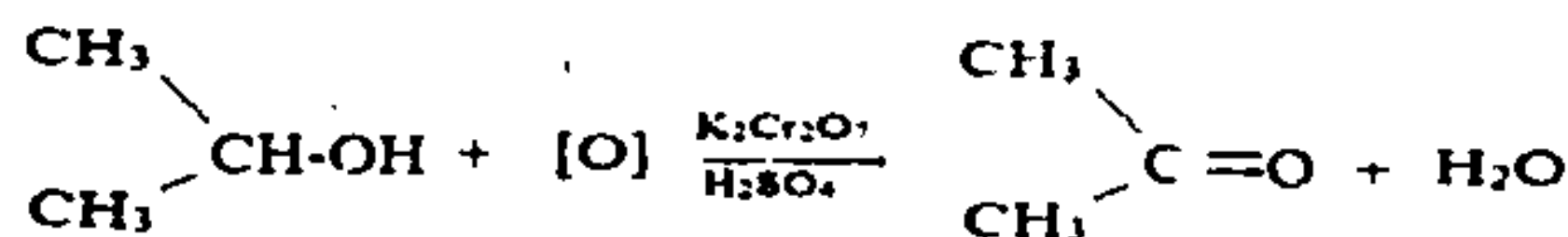
$CH_3\text{-}CH_2\text{-}OH + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}H + H_2O$

Iso-Propyl Alcohols:

$(CH_3)_2CH\text{-}OH + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} (CH_3)_2C{=}O + H_2O$

33 How will you convert propanol into propanone?

Ans:

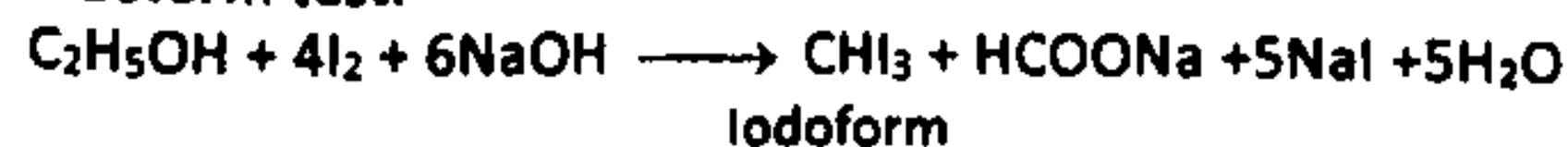
$(CH_3)_2CH\text{-}OH + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} (CH_3)_2C{=}O + H_2O$

Topic No: 11.3

34 How will you distinguish between methanol & ethanol? (9 times)

Ans: Ethanol gives iodoform with iodine in the presence of NaOH. Formation of yellow crystals indicate that the alcohol is ethanol. Methanol does not give iodoform test.

$C_2H_5OH + 4I_2 + 6NaOH \longrightarrow CHI_3 + HCOONa + 5NaI + 5H_2O$

Iodoform

$CH_3OH + I_2 + NaOH \longrightarrow$ No Reaction.

35 Distinguish ethanol and tertiary butyl alcohol by Lucas test? (2 times)

Ans: Primary, secondary and tertiary alcohols are identified and distinguished by reacting them with con. HCl in anhydrous $ZnCl_2$. An oily layer of alkyl halides separates out in these reactions:

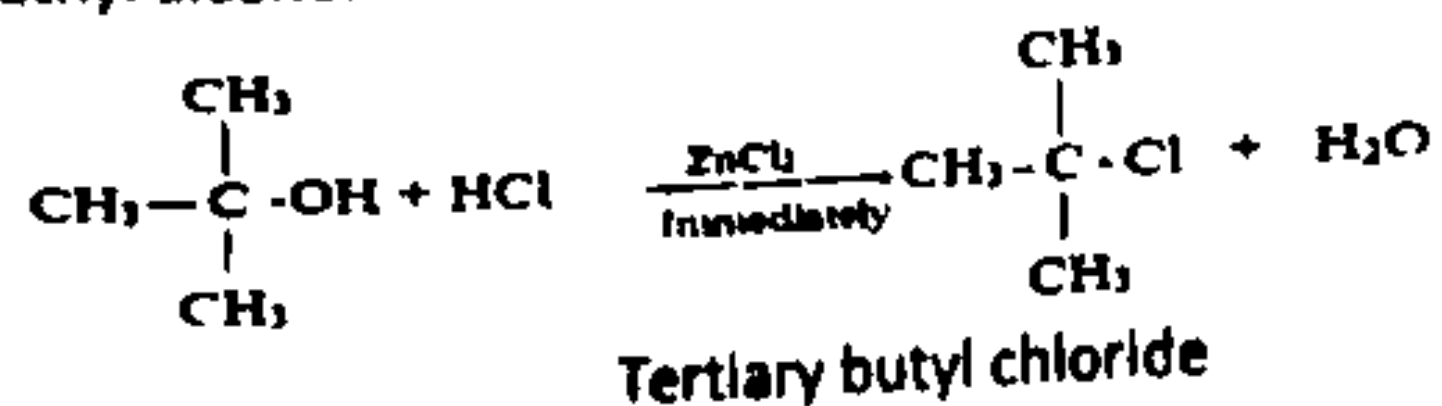
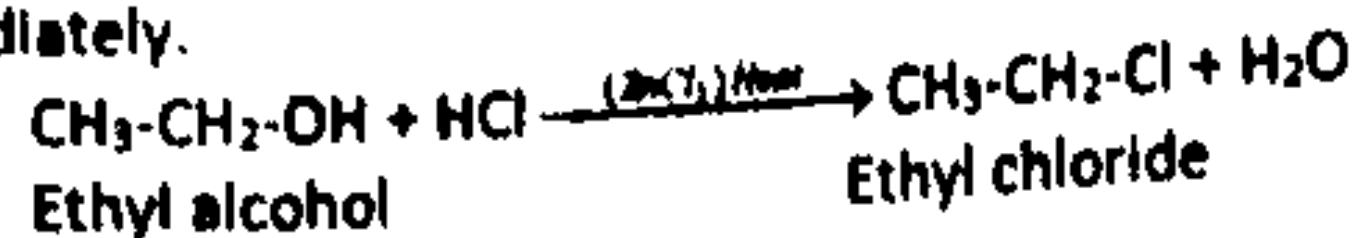
(i). Ethanol is a primary alcohol which forms an oily layer only on heating.

(ii).. Tertiary butyl alcohol is a tertiary alcohol which forms an oily layer immediately.

$$CH_3\text{-}CH_2\text{-}OH + HCl \xrightarrow{(ZnCl_2)/Heat} CH_3\text{-}CH_2\text{-}Cl + H_2O$$

Ethyl alcohol — Ethyl chloride

$$(CH_3)_3C\text{-}OH + HCl \xrightarrow[Immediately]{ZnCl_2} (CH_3)_3C\text{-}Cl + H_2O$$

Tertiary butyl chloride

36 Write a note on Lucas Test? (2 times)

Ans: Primary, secondary and tertiary alcohols are identified and distinguished by reacting them with con. HCl in anhydrous $ZnCl_2$. An oily layer of alkyl halides separates out in these reactions:

(i).. Tertiary alcohols form an oily layer immediately.

(ii).. Secondary alcohols for an oily layer in five to ten minutes.

(iii). Primary alcohols form an oily layer only on heating.

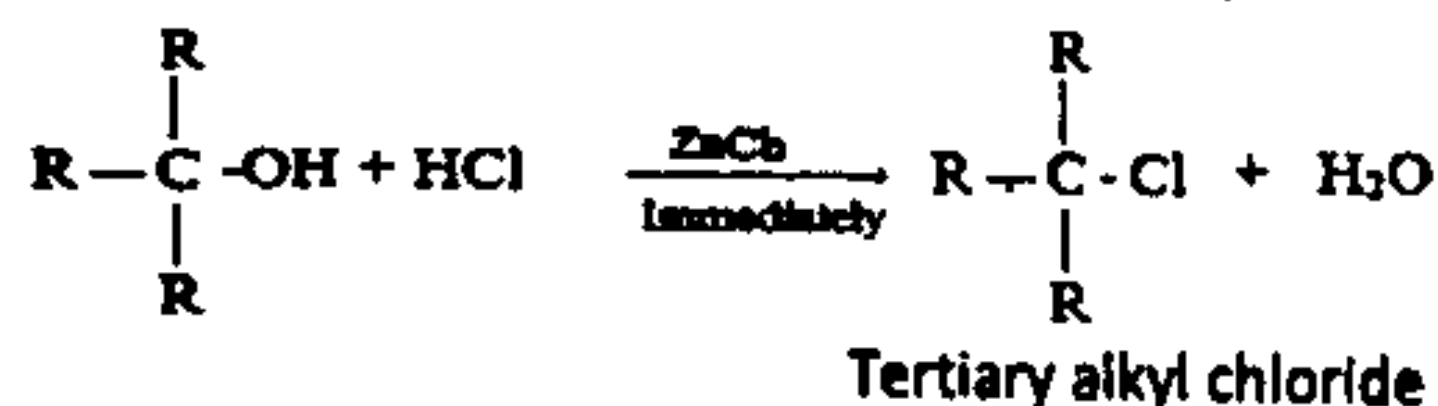
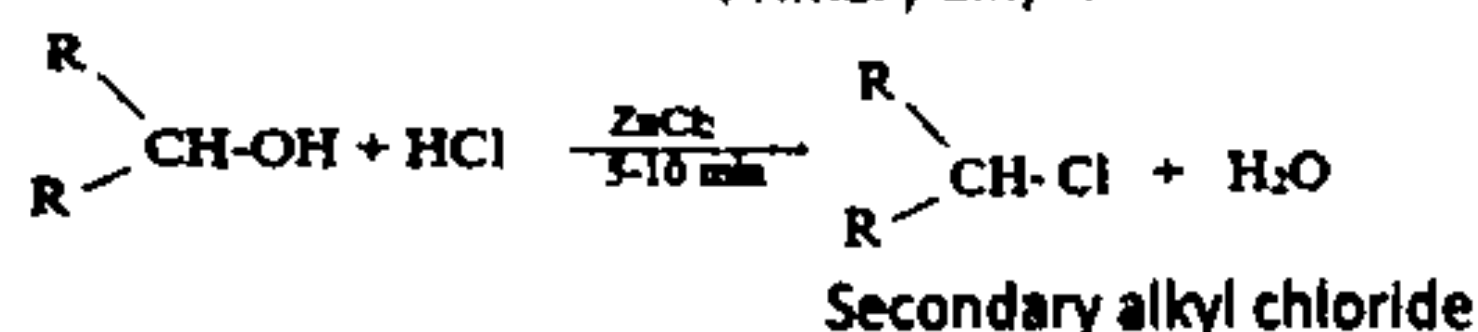
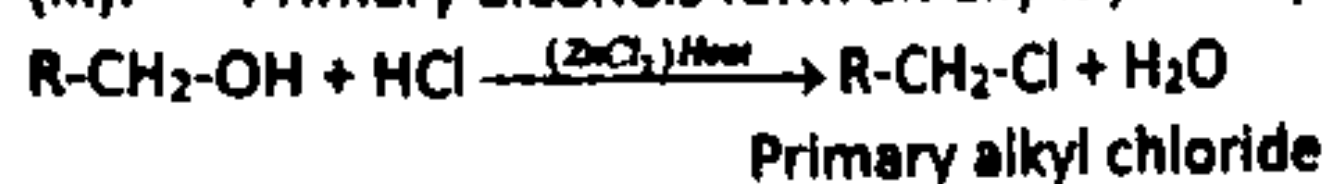
$$R\text{-}CH_2\text{-}OH + HCl \xrightarrow{(ZnCl_2)/Heat} R\text{-}CH_2\text{-}Cl + H_2O$$

Primary alkyl chloride

$$R_2CH\text{-}OH + HCl \xrightarrow[5\text{-}10\ min]{ZnCl_2} R_2CH\text{-}Cl + H_2O$$

Secondary alkyl chloride

$$R_3C\text{-}OH + HCl \xrightarrow[Immediately]{ZnCl_2} R_3C\text{-}Cl + H_2O$$

Tertiary alkyl chloride

37 How will you distinguish between 1-propanol and 2-propanol? (3 times)

Ans: 1-propanol is a primary alcohol while 2-propanol is a secondary alcohol.

Primary, secondary and tertiary alcohols are identified and distinguished by reacting them with con. HCl in anhydrous $ZnCl_2$. An oily layer of alkyl halides separates out in these reactions:

(i).. Tertiary alcohols form an oily layer immediately.

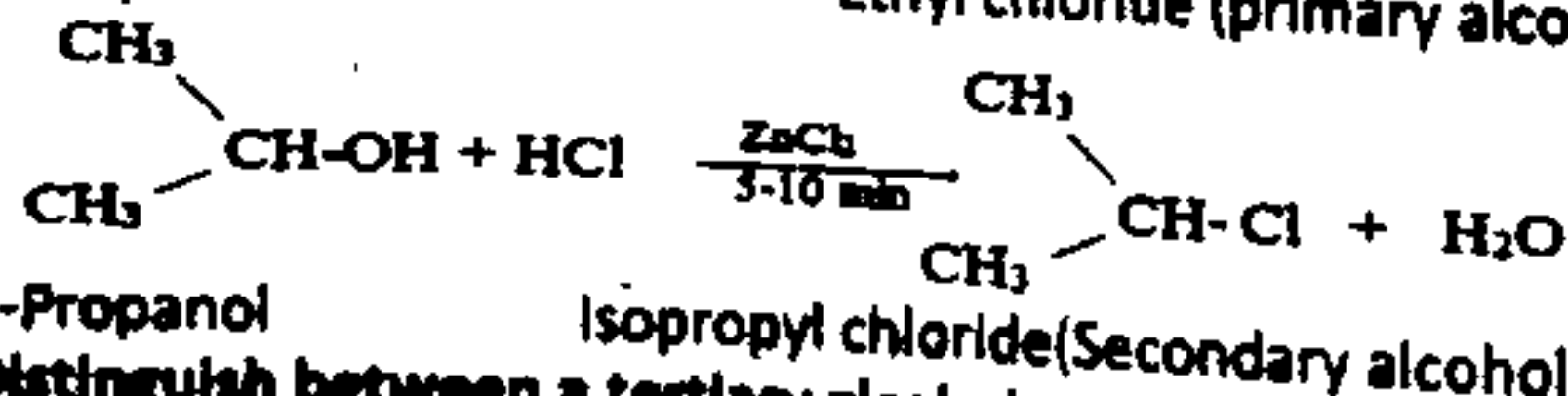
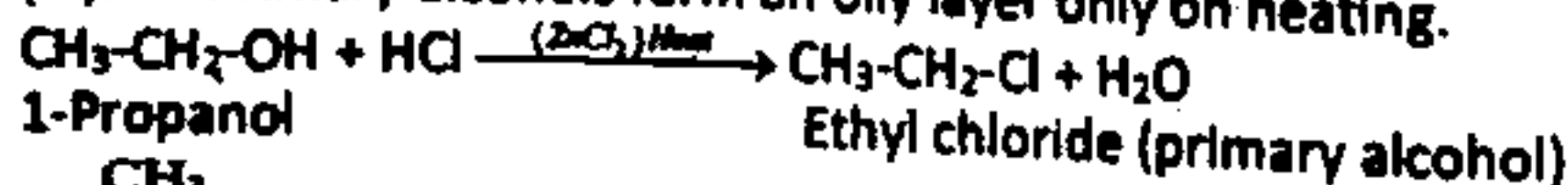
(ii).. Secondary alcohols for an oily layer in five to ten minutes.

(iii). Primary alcohols form an oily layer only on heating.

$$CH_3\text{-}CH_2\text{-}OH + HCl \xrightarrow{(ZnCl_2)/Heat} CH_3\text{-}CH_2\text{-}Cl + H_2O$$

1-Propanol — Ethyl chloride (primary alcohol)

$$(CH_3)_2CH\text{-}OH + HCl \xrightarrow[5\text{-}10\ min]{ZnCl_2} (CH_3)_2CH\text{-}Cl + H_2O$$

2-Propanol — Isopropyl chloride(Secondary alcohol)

38 Distinguish between a tertiary alcohol and a primary alcohol? (2 times)

Ans: Primary and tertiary alcohols are identified and distinguished by reacting them with con. HCl in anhydrous $ZnCl_2$. An oily layer of alkyl halides separates out in these reactions:

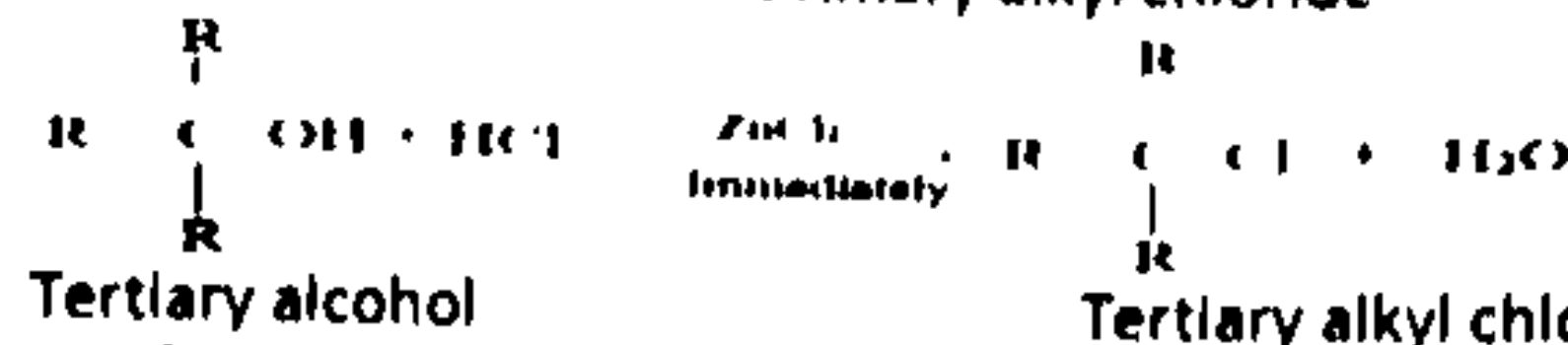
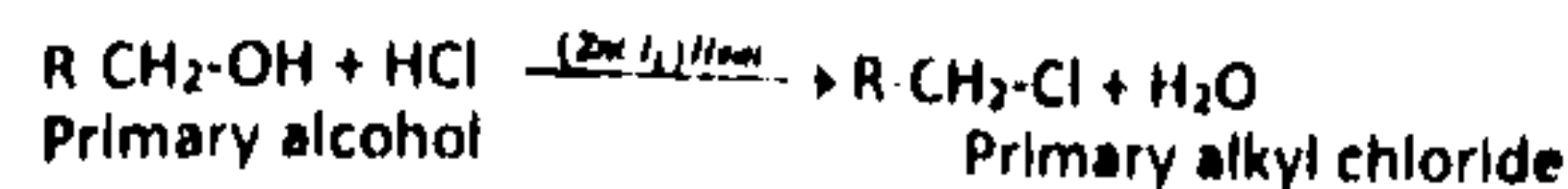
Primary alcohols form an oily layer only on heating.

Tertiary alcohols form an oily layer immediately.

$$R\ CH_2\text{-}OH + HCl \xrightarrow{(ZnCl_2)/Heat} R\text{-}CH_2\text{-}Cl + H_2O$$

Primary alcohol — Primary alkyl chloride

$$R_3C\text{-}OH + HCl \xrightarrow[Immediately]{ZnCl_2} R_3C\text{-}Cl + H_2O$$

Tertiary alcohol — Tertiary alkyl chloride

39 How secondary and tertiary Alcohols can be distinguished by Lucas Test? (3 times)

Ans: Secondary and tertiary alcohols are identified and distinguished by reacting them with con. HCl in anhydrous $ZnCl_2$. An oily layer of alkyl halides separates out in these reactions:

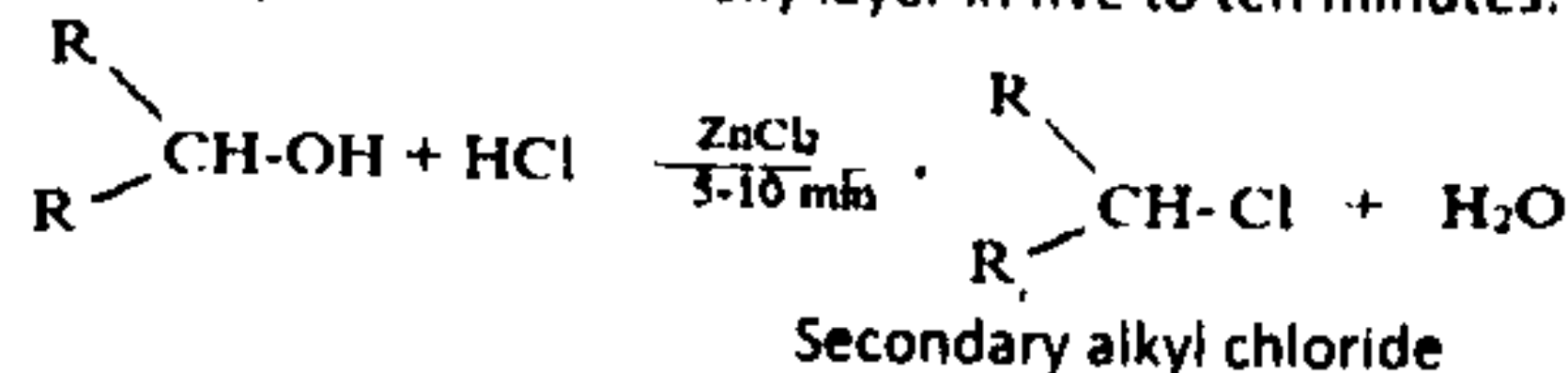
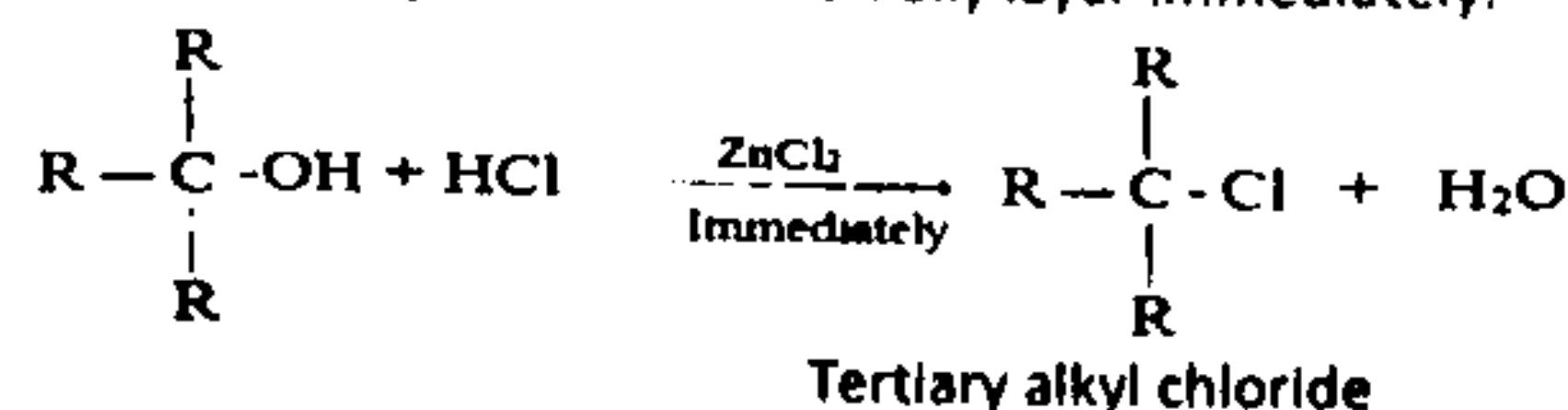
(i) Secondary alcohols for an oily layer in five to ten minutes.

$$R_2CH\text{-}OH + HCl \xrightarrow[5\text{-}10\ min]{ZnCl_2} R_2CH\text{-}Cl + H_2O$$

Secondary alkyl chloride

(i).. Tertiary alcohols form an oily layer immediately.

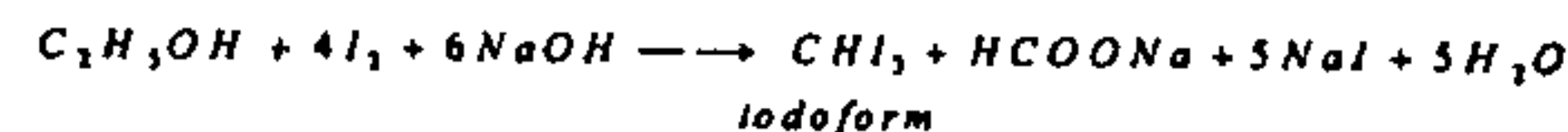
$$R_3C\text{-}OH + HCl \xrightarrow[Immediately]{ZnCl_2} R_3C\text{-}Cl + H_2O$$

Tertiary alkyl chloride

40. Why are lower alcohols more soluble in water than higher alcohols

Ans: Lower alcohols more soluble in water than higher alcohols because solubility of alcohols is due to hydrogen bonding which is prominent in lower alcohols but diminishes in higher alcohols.

41. Convert ethanol to iodoform.

Ans:

$$C_2H_5OH + 4I_2 + 6NaOH \longrightarrow \underset{Iodoform}{CHI_3} + HCOONa + 5NaI + 5H_2O$$

Topic No: 11.4

42 Write four uses of each methanol and ethanol (ethyl alcohol). (4 times)

Ans: **Methanol** is used as solvent for fats oils, paints, varnishes, it is also used as antifreeze in the radiators of automobiles and for denaturing of alcohol.

Ethanol is used as a solvent, as a drink and as a fuel in some countries. Moreover, it is used in pharmaceutical preparations and as a preservatives for biological specimen.

43 Give any four uses of methyl alcohol? (2 times)

Ans: (i).. It is used as solvent for fats oils, paints, varnishes.

(ii).. It is also used as antifreeze in the radiators of automobiles.

(iii).. It is used for denaturing of alcohol.

(iv).. It is used as a volatile liquid in gas chromatography(GC).

44 What are the important uses of alcohol? (2 times)

Ans: **Methanol** is used as solvent for fats oils, paints, varnishes, it is also used as antifreeze in the radiators of automobiles and for denaturing of alcohol.

Ethanol is used as a solvent, as a drink and as a fuel in some countries. Moreover, it is used in pharmaceutical preparations and as a preservatives for biological specimen.

Topic No: 11.5

45 Distinguish between an alcohol and a phenol by a chemical reaction? (2 times)

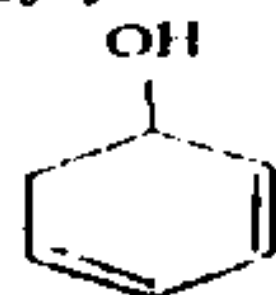
Ans: (i).. Alcohols does not react with bases but phenol reacts and give salts.

(ii).. Alcohols react with bromine water and phenol reacts to give white ppt of tribromophenol.

46. Write formula of carbolic acid and its one use.

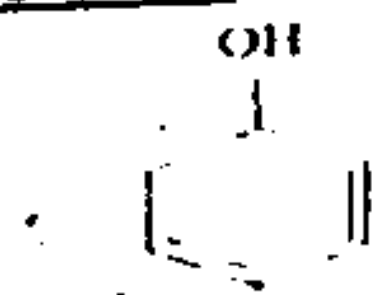
Ans: **Formula of carbolic acid:**

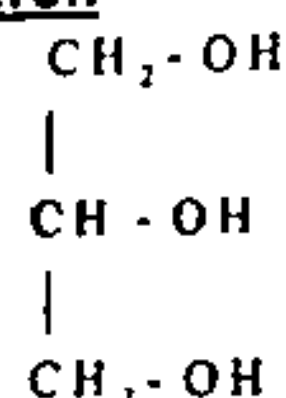
Carbolic acid: C_6H_5OH

OH

Uses: It is poisonous and used as a disinfectant in hospitals and washrooms.

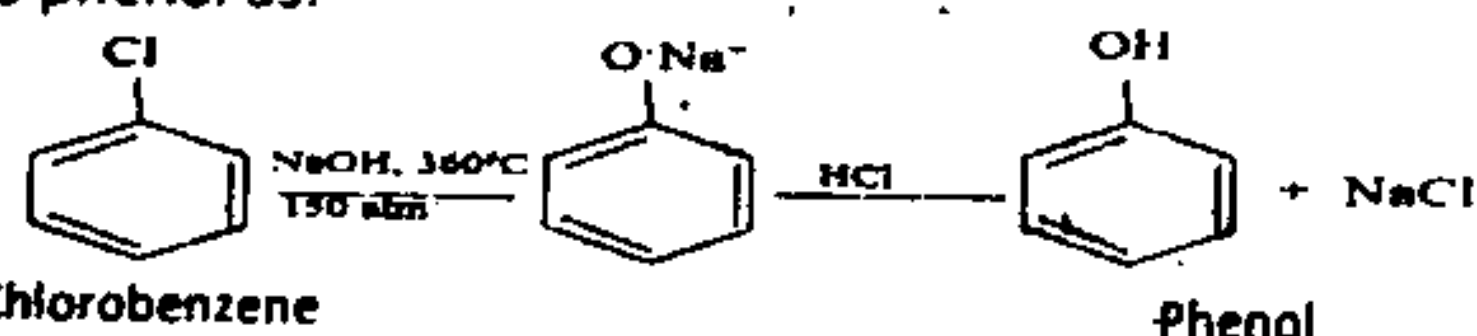
47. Write structural formula of the compounds.: (a) Carbolic acid (b) Glycerol.

Ans: **Structural formula of Carbolic acid:**

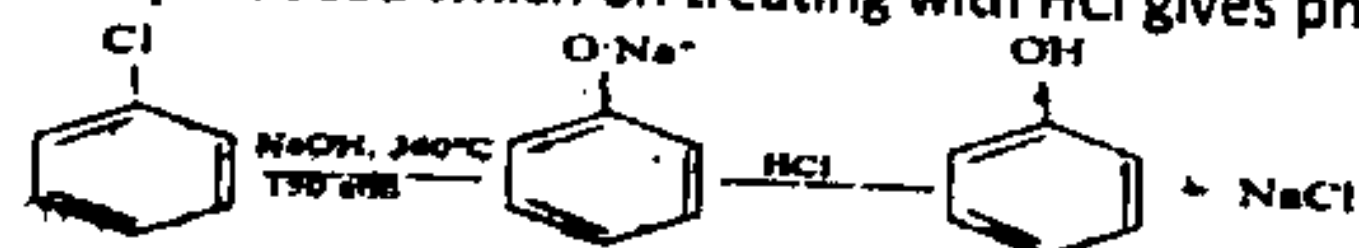
OH

Structural formula of Glycerol:

CH_2-OH
|
$CH-OH$
|
CH_2-OH

Topic No: 11.5.1

48 Prepare phenol from chlorobenzene by Dow's method? (6 times)

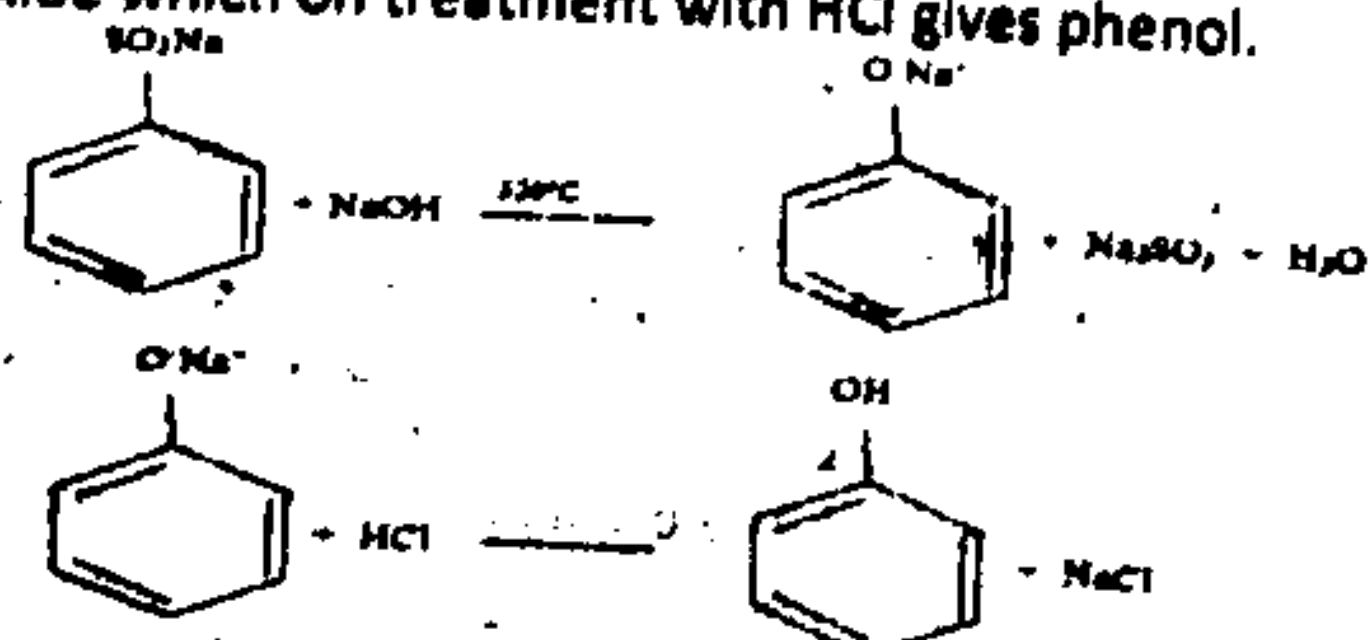
Ans: In Dow's method chlorobenzene is treated with 10% NaOH at 360ºC and 150 atmospheres pressure. Sodium phenoxide is produced which on treating with HCl gives phenol as:

Chlorobenzene —(NaOH, 360°C, 150 atm)→ O^-Na^+ —(HCl)→ Phenol (OH) + NaCl

49 Write down two methods for the preparation of phenol? (4 times)

Ans: **(i).. Prepare phenol by Dow's method:-** In Dow's method chlorobenzene is treated with 10% NaOH at 360ºC and 150 atmospheres pressure. Sodium phenoxide is produced which on treating with HCl gives phenol as:

Chlorobenzene —(NaOH, 360°C, 150 atm)→ O^-Na^+ —(HCl)→ Phenol (OH) + NaCl

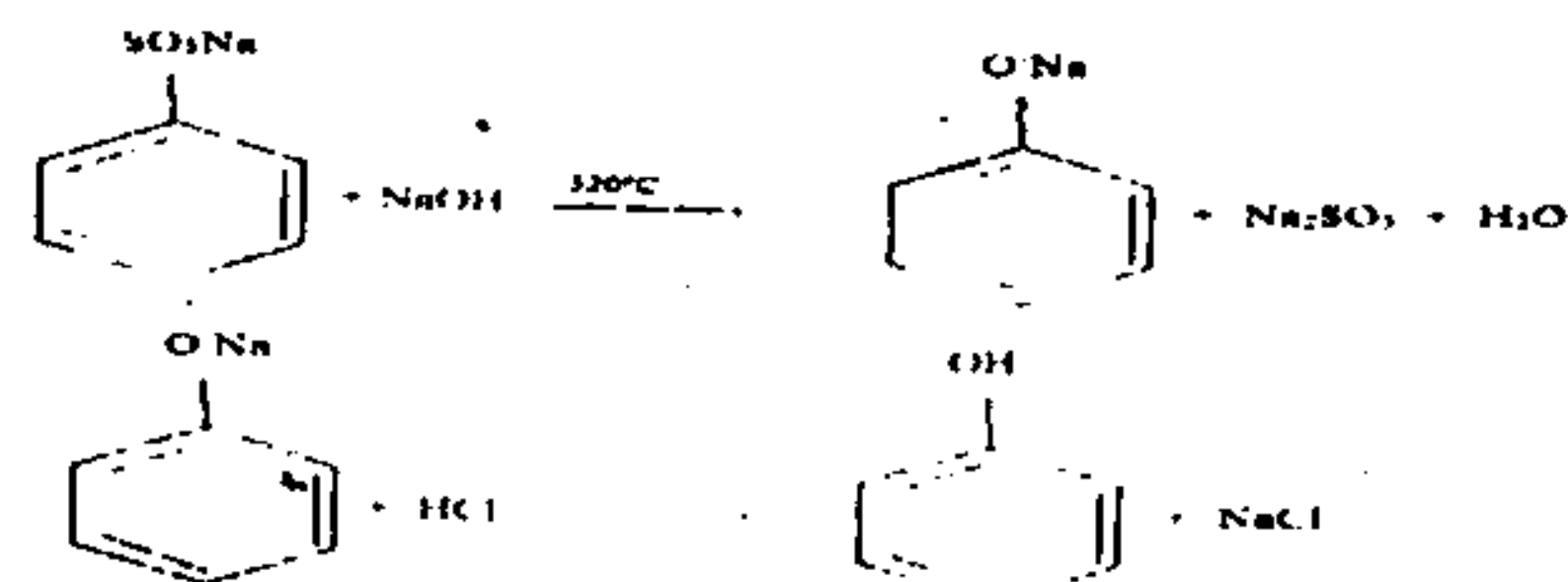
(ii).. Prepare phenol by Sodium salt of benzene sulphonic acid:- Sodium salt of benzene sulphonic acid reacts with NaOH at 320ºC to give sodium phenoxide which on treatment with HCl gives phenol.

SO_3Na + NaOH —(320°C)→ O^-Na^+ + Na_2SO_3 + H_2O

O^-Na^+ + HCl → OH + NaCl

50. Describe a method for preparation of phenol from sodium salt of benzene sulphonic acid.

Ans: Sodium salt of benzene sulphonic acid reacts with NaOH at 320ºC to give sodium phenoxide which on treatment with HCl gives phenol.

SO_3Na + NaOH —(320°C)→ ONa + Na_2SO_3 + H_2O

ONa + HCl → OH + NaCl

Topic No: 11.5.4

51 Why Phenol is acidic while alcohol is not? (5 times)

Ans: **Phenol is acidic:-** Phenol is much more acidic than alcohols but less acidic than carboxylic acids. Phenoxide formed by the dissociation of phenol. The negative charge on oxygen atom can become involved with the π-electron cloud on the benzene ring. The negative charge is thus delocalized in the ring and the phenoxide ion becomes relatively stable. This type of delocalization is not possible in alcohols.

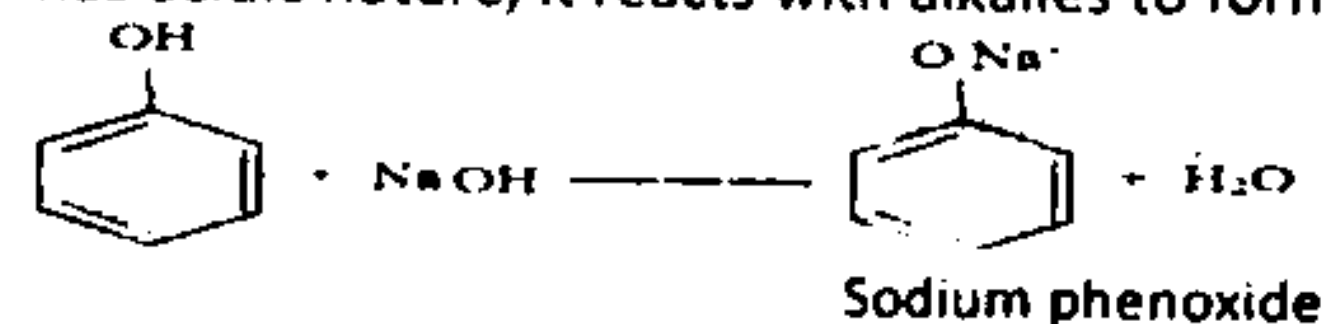
52 Explain acidic behaviour of phenol. (5 times)

Ans: Phenoxide ion is formed by the dissociation of phenol. The negative charge on oxygen atom can become involved with the π-electron cloud on the benzene ring. The negative charge is thus delocalized in the ring and the phenoxide ion becomes relatively stable.

Topic No: 11.5.5

53 How does phenol react with alkali?

Ans: Phenol has acidic nature, it reacts with alkalies to form salts. For example:

OH + NaOH → O^-Na^+ + H_2O

Sodium phenoxide

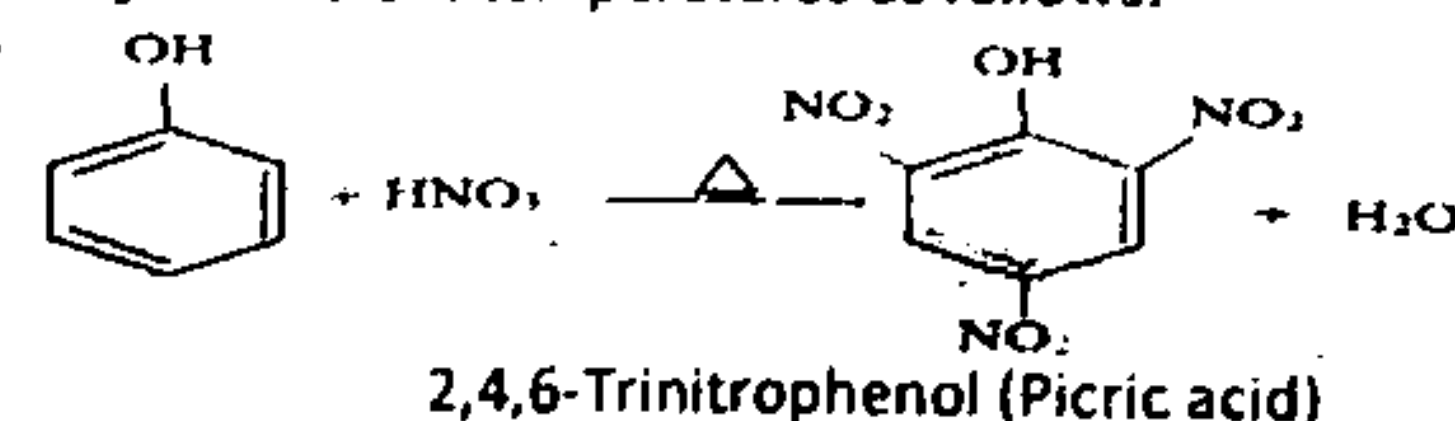
54 Prepare Benzene and Picric acid from Phenol?

Ans: Benzene is prepared by the reduction of phenol in the presence of Zn as:

OH + Zn —(Δ)→ Benzene + ZnO

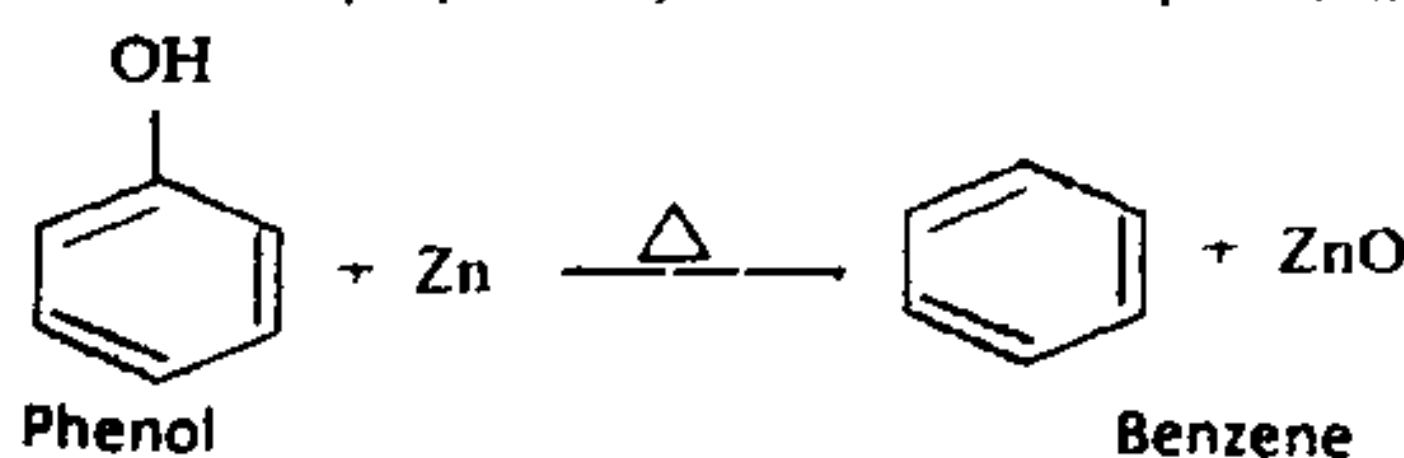
Phenol Benzene

Picric acid is synthesized by the nitration of phenol. Phenol reacts with dil and conc. HNO_3 at different temperatures as follows:

OH + HNO_3 —(Δ)→ OH, NO_2, NO_2, NO_2 + H_2O

2,4,6-Trinitrophenol (Picric acid)

55 How phenol can be converted into Benzene?

Ans: Benzene is prepared by the reduction of phenol in the presence of Zn as:

OH + Zn —(Δ)→ Benzene + ZnO

Phenol Benzene

56. How phenol is identified chemically?

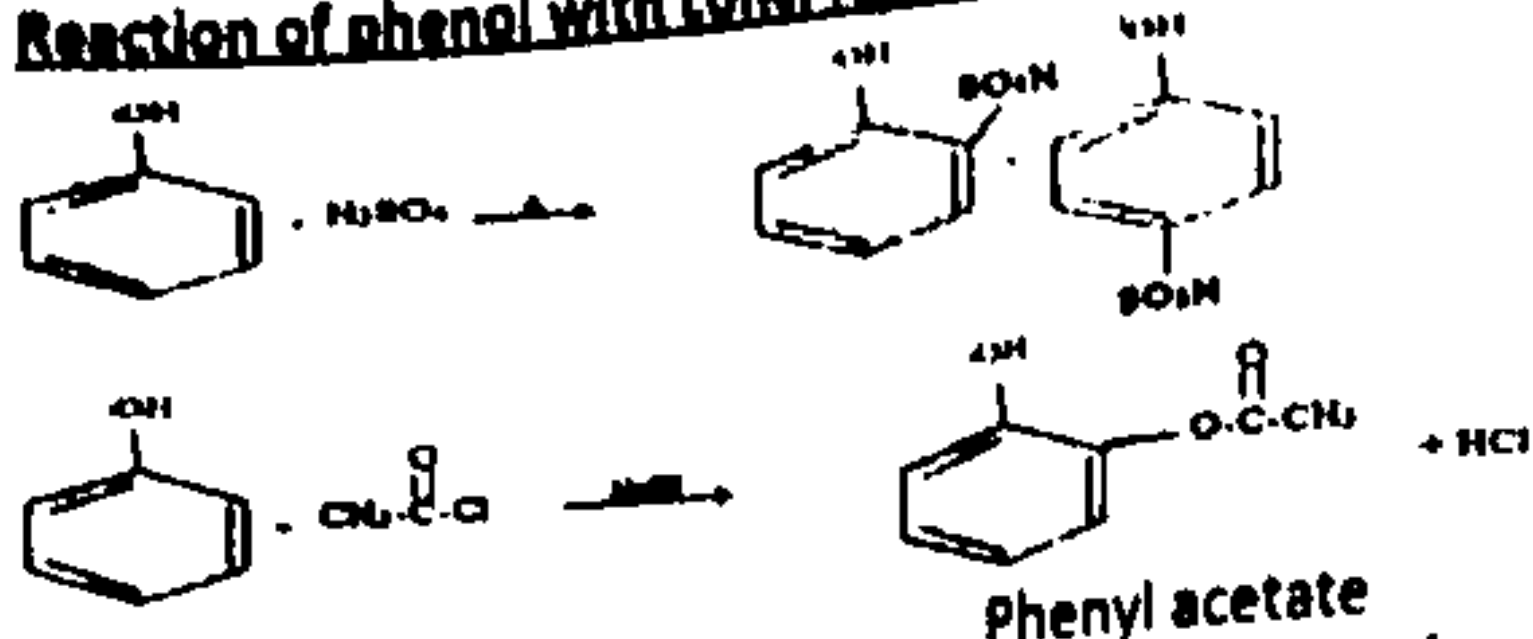
Ans: An aqueous solution of phenol reacts with bromine water to give white ppt. of 2,4,6 tribromophenol. Thus the colour of bromine is discharged.

57. Give the reaction of phenol with conc. H_2SO_4 and acetyl chloride.

Ans: **Reaction of phenol with conc. H_2SO_4 and acetyl chloride:**

Phenol + H_2SO_4 → o-phenolsulphonic acid + p-phenolsulphonic acid

Phenol + CH_3COCl → phenyl acetate + HCl

Phenyl acetate

58. Define the following terms (i) Phenols (ii) Oxonium ions.

Ans: **Definitions:**

Aromatic compounds which contain one or more OH groups directly attached with carbon of benzene ring are called **Phenols**. The simplest example is phenol which is also known as Carbolic acid i.e. C_6H_5OH.

59. Write reaction of phenol with (a) Bromine water (b) Conc. HNO_3

Ans: **(a) Bromine water**

An aqueous solution of phenol reacts with bromine water to give white ppt 2,4,4- tribromophenol.

$$C_6H_5OH + 3Br_2 \longrightarrow C_6H_2Br_3OH$$

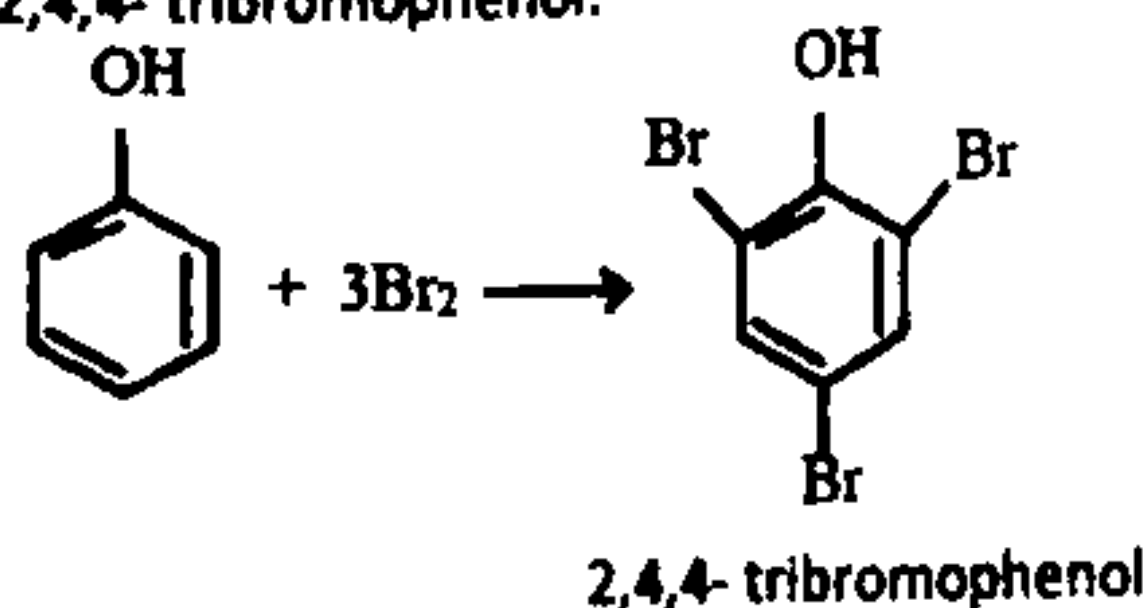
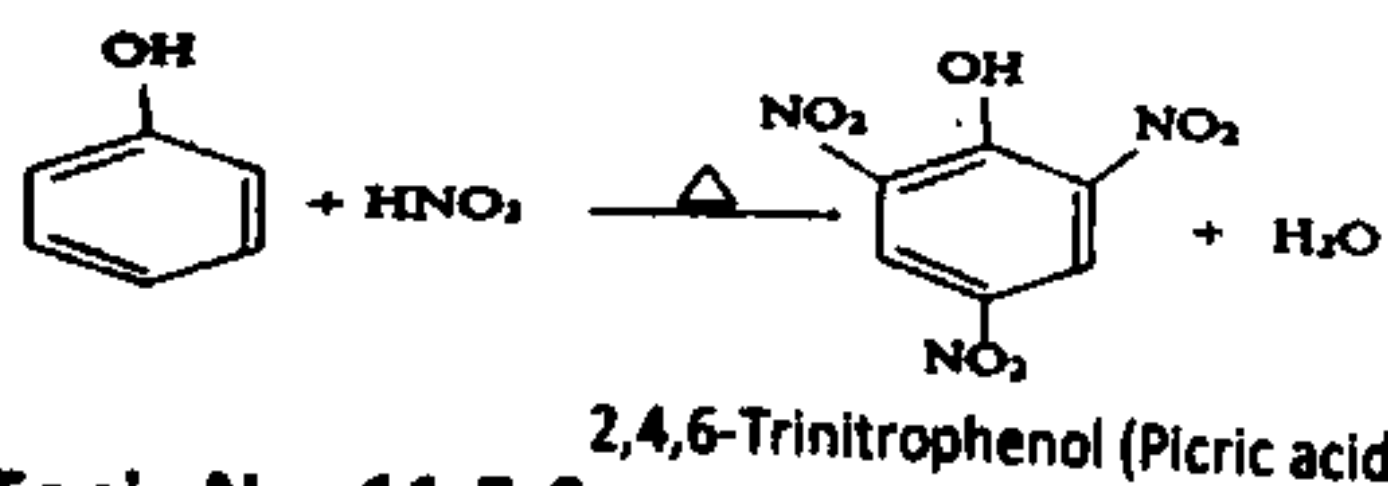
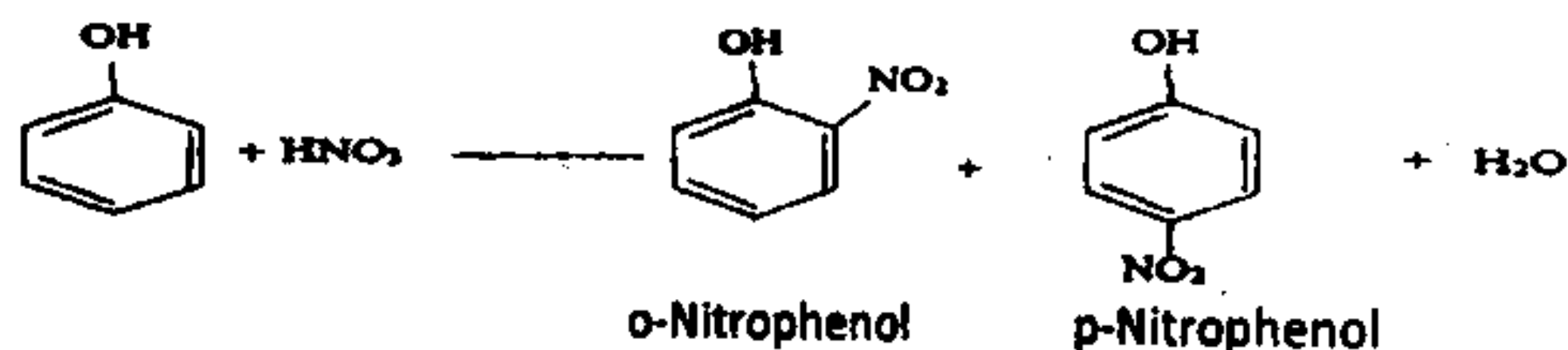
2,4,4- tribromophenol

(b) Conc. HNO_3

$$C_6H_5OH + HNO_3 \longrightarrow \text{o-Nitrophenol} + \text{p-Nitrophenol} + H_2O$$

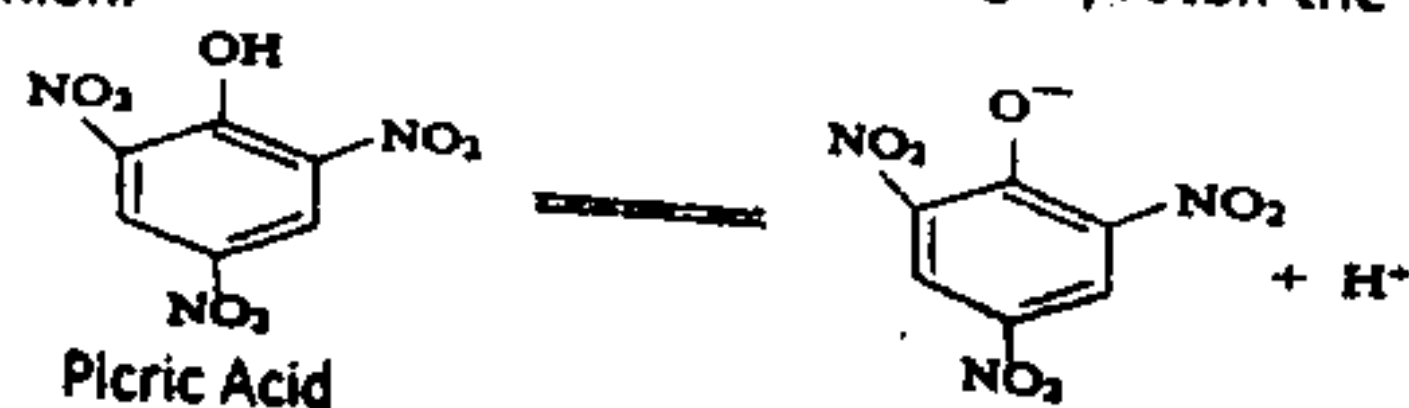
o-Nitrophenol p-Nitrophenol

$$C_6H_5OH + HNO_3 \xrightarrow{\Delta} C_6H_2(NO_2)_3OH + H_2O$$

2,4,6-Trinitrophenol (Picric acid)

Topic No: 11.5.6

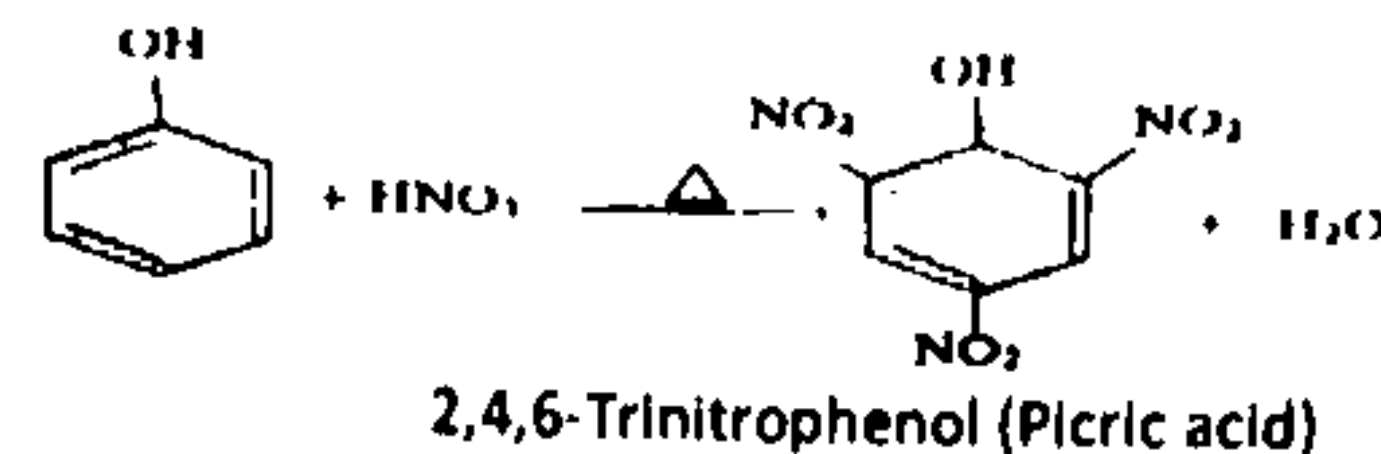
60 Picric acid is a phenol which behaves like an acid. Justify.

Ans: Picric acid is 2,4,6-trinitrophenol. It is actually phenol but has three nitro groups attached to the benzene ring of phenol. Nitro groups are electron withdrawing in nature. Nitro groups attracts electrons to themselves and makes easy phenolic part to donate proton easily, so picric acid can donate a proton and behave like an acid. Moreover, after donating a proton the base of picric acid stable anion.

Picric Acid ⇌ picrate ion + H^+

Picric Acid

61 How does picric acid synthesis take place?

Ans: Picric acid is synthesized by the nitration of phenol. Phenol reacts with dil and conc. HNO_3 at different temperatures as follows:

$$C_6H_5OH + HNO_3 \xrightarrow{\Delta} C_6H_2(NO_2)_3OH + H_2O$$

2,4,6-Trinitrophenol (Picric acid)

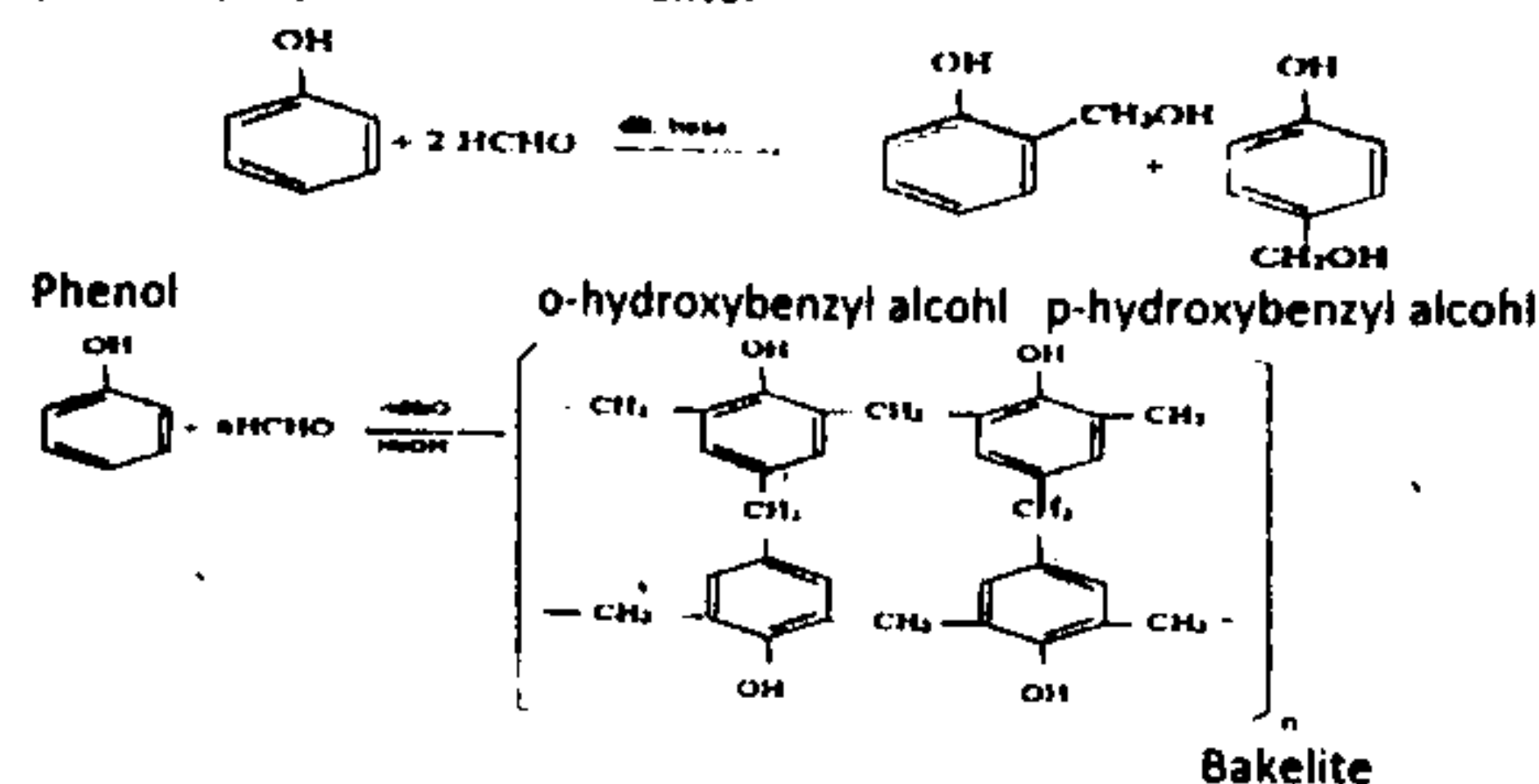
62 Give chemical reactions for preparation of Bakelite? (2 times)

Ans: Phenol reacts with formaldehyde in the presence of acid or alkali to give hydroxyl benzyl alcohol which on further reaction with other phenol molecules yields a polymer called bakelite.

Phenol + 2 HCHO → o-hydroxybenzyl alcohl + p-hydroxybenzyl alcohl

Phenol o-hydroxybenzyl alcohl p-hydroxybenzyl alcohl

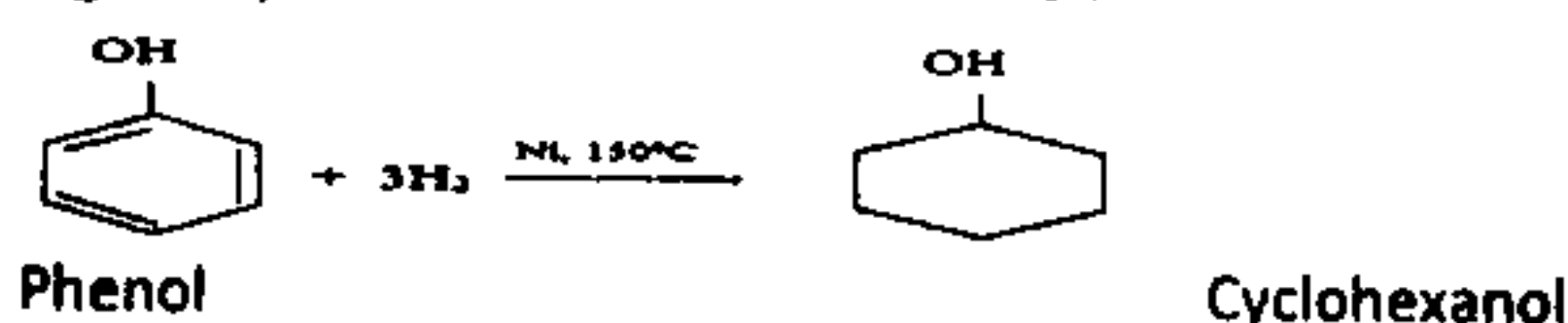
Phenol + HCHO → Bakelite

Bakelite

63 Convert phenol to an alcohol?

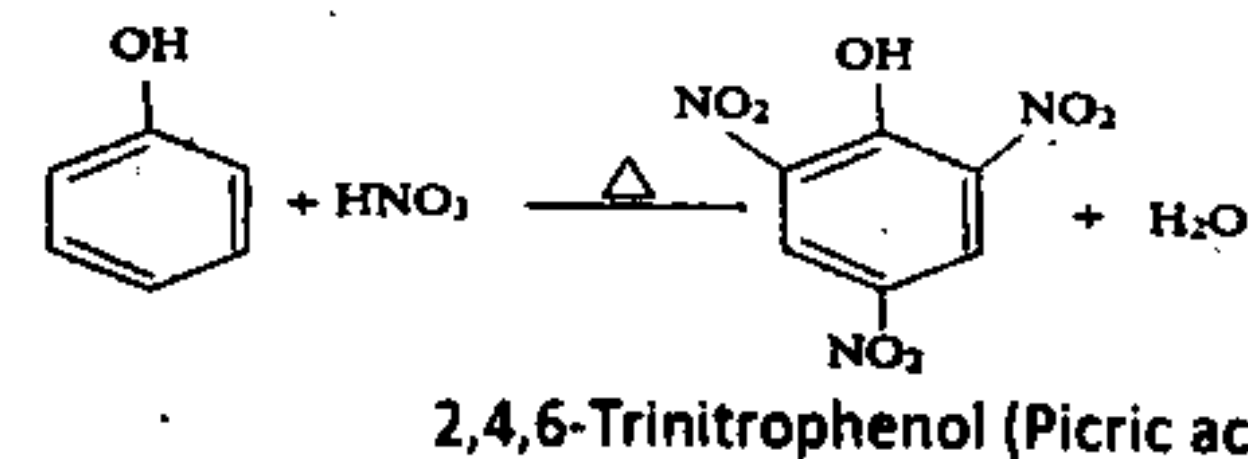
Ans: **Conversion of phenol to an alcohol:-**

When hydrogen is passed through phenol at 150C in the presence of Ni catalyst it gives cyclohexanol which is an alcohol.

$$C_6H_5OH + 3H_2 \xrightarrow{Ni,\ 150^\circ C} C_6H_{11}OH$$

Phenol Cyclohexanol

64 Conc.HNO_3 reacts with Phenol to give picric acid .How ?

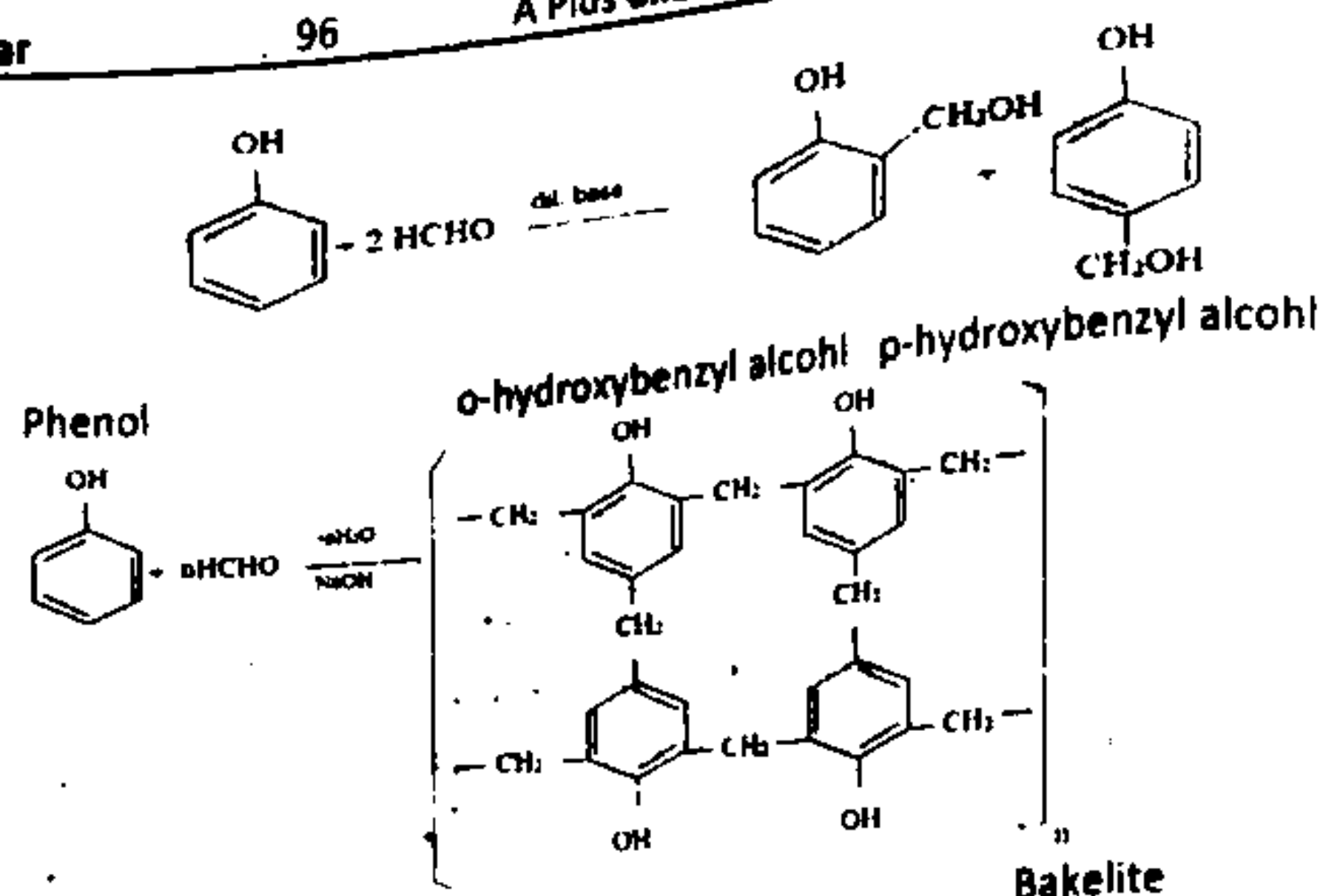
Ans: Picric acid is synthesized by the nitration of phenol. Phenol reacts with conc. HNO_3 at different temperatures as follows:

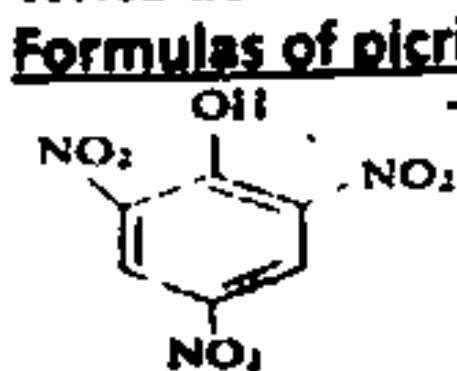
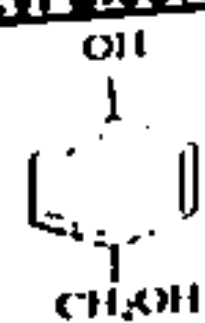
$$C_6H_5OH + HNO_3 \xrightarrow{\Delta} C_6H_2(NO_2)_3OH + H_2O$$

2,4,6-Trinitrophenol (Picric acid)

65. Write the reaction of phenol with methanal.

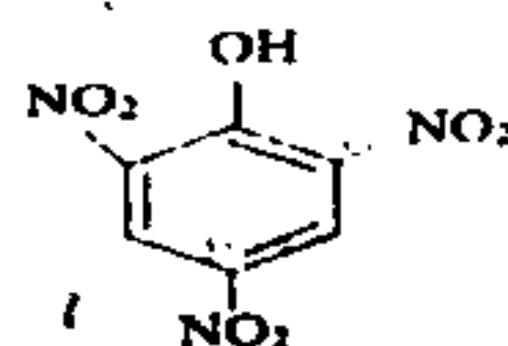
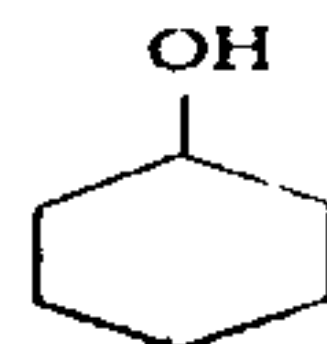
Ans: Phenol reacts with formaldehyde in the presence of acid or alkali to give hydroxyl benzyl alcohol which on further reaction with other phenol molecules yields a polymer called bakelite.

Phenol + 2 HCHO —(dil. base)→ o-hydroxybenzyl alcohl + p-hydroxybenzyl alcohl

Phenol + nHCHO —(H_2O, NaOH)→ Bakelite

66. Write down the formulas of picric acid and p-hydroxy benzyl alcohol.

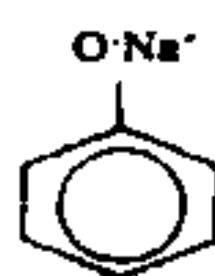
Ans: **Formulas of picric acid and p-hydroxy benzyl alcohol:**

(i). Picric acid:

(ii). p-hydroxy benzyl alcohol:

67 Draw the structures of picric acid and cyclo-hexanol.

Ans:

(2,4,6- Trinitrophenol) (Picric acid)

Cyclo-hexanol

Topic No: 11.6

68 Write down the structural formulas of sodium phenoxide and methoxyethane

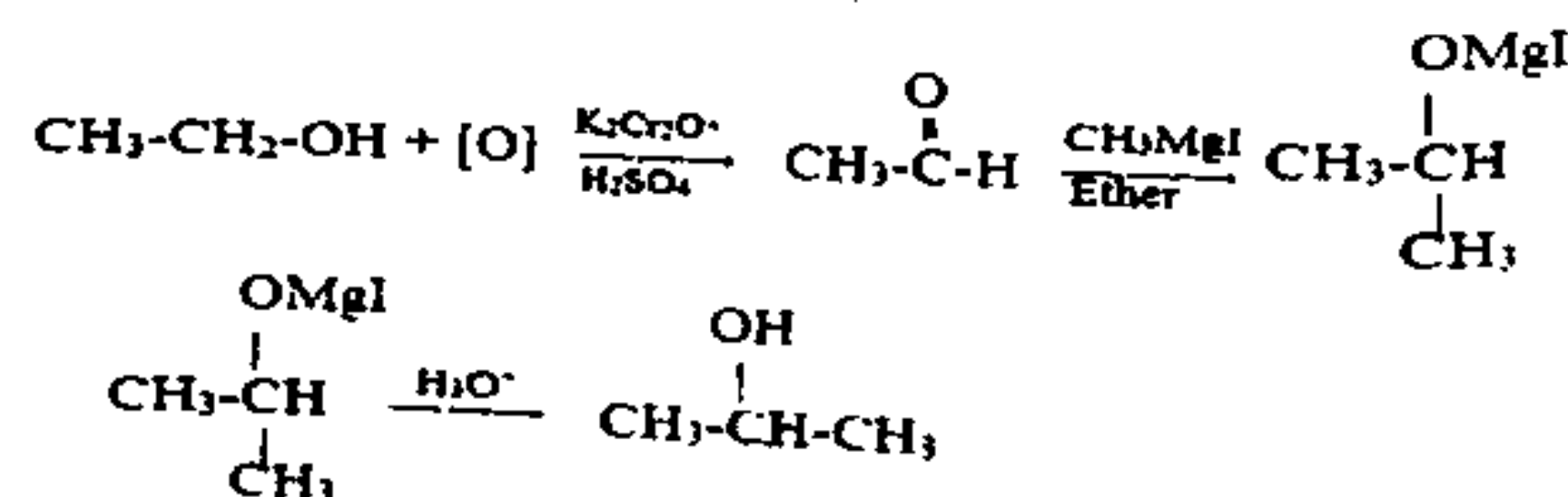
Ans: **Structural formulas of sodium phenoxide and methoxy ethane:-**

Sodium phenoxide: (O^-Na^+)

Topic No: 11.6.2

69 Convert Ethanol into isopropyl alcohol?

Ans: **Conversion of Ethanol into isopropyl alcohol:-**

$$CH_3\text{-}CH_2\text{-}OH + [O] \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}H \xrightarrow[Ether]{CH_3MgI} CH_3\text{-}\underset{CH_3}{\underset{|}{\overset{OMgI}{\overset{|}{C}H}}}$$

$$CH_3\text{-}\underset{CH_3}{\underset{|}{\overset{OMgI}{\overset{|}{C}H}}} \xrightarrow{H_3O^+} CH_3\text{-}\overset{OH}{\overset{|}{C}H}\text{-}CH_3$$

Isopropyl alcohol

70 Arrange the given compounds in order of increasing acid strength. H_2O, C_2H_5OH , phenol, Benzoic acid?

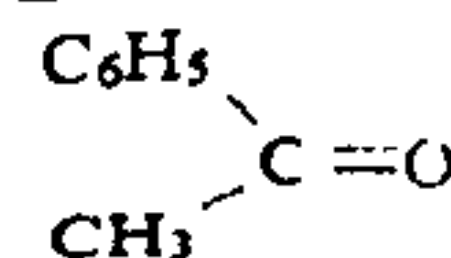
Ans: C_2H_5OH < H_2O <phenol<Benzoic acid

71. Write down the formula of Acetophenone and Benzyl Alcohol.

Ans: **Formula of Acetophenone and Benzyl Alcohol:**

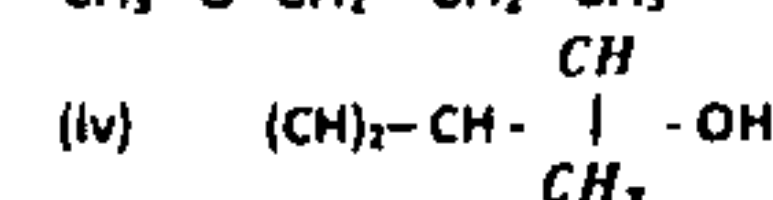
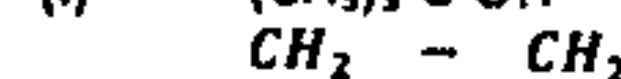
$C_6H_5(CH_3)C=O$

Acetophenone

$C_6H_5\text{-}CH_2\text{-}OH$

Benzyl alcohol:

LONG QUESTIONS OF CHAPTER- 11
ALCOHOLS, PHENOLS AND ETHER
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 11.2.1

1. Write I.U.P.A.C. names of followings : Compounds are given:
   (i) $(CH_3)_3\text{-}C\text{-}OH$ (ii) $CH_3\text{-}O\text{-}CH_2\text{-}CH_2\text{-}CH_3$
   (iii) $\underset{OH}{CH_2} - \underset{OH}{CH_2}$ (iv) $(CH)_2\text{-}CH\text{-}\overset{CH}{\underset{CH_3}{|}}\text{-}OH$

Ans: (Text Book Page No:212)

2. How are monohydric alcohols classified? Write preparation of ethyl alcohol from molasses.

Ans: (Text Book Page No:218)

Topic No: 11.2.2

3. How ethyl alcohol is obtained by the fermentation of molasses and starch? (5 times)

Ans: (Text Book Page No:215)

4. Give industrial preparation of ethyl alcohol. (2 times)

Ans: (Text Book Page No:215)

5. How methanol is prepared in industry?

Ans: (Text Book Page No:231)

6. How is methyl alcohol is obtained on large scale from water gas? Draw diagram also.

Ans: (Text Book Page No:214)

7. How is methyl alcohol is obtained on large scale? How is it distinguished from ethyl alcohol.

Topic No: 11.2.4

8. Convert methanol to ethanol and ethanol to methanol.

9. Prepare ethyl acetate. Ethanol, ethane and diethyl ether from ehthanol.

Ans: (Text Book Page No:223)

Topic No: 11.2.5

10. Write the Chemical reactions of C_2H_5OH with followings with conditions.
(i) $SOCl_2$ (ii) HCl (iii) NH_3 (iv) Na

Ans: (Text Book Page No:217)

Topic No: 11.2.7

11. Explain the following terms using ethyl alcohol:
Oxidation ii) Dehydration

Ans: (Text Book Page No:217+218)

12. Describe reactions of ethanol and propanone with (i) Hydroxylamine (ii) Phenylhydrazine

Ans: (Text Book Page No:217)

13. Describe the ease of dehydration of primary, secondary and tertiary alcohol with suitable reagent.
Ans: (Text Book Page No:217)
14. How does ethyl alcohol react with following reagents:
(i) Conc.H_2SO_4 (ii) Na (iii) CH_3COOH (iv) $SOCl_2$
Ans: (Text Book Page No:217)

Topic No: 11.3

15. How will you distinguish between primary, secondary and tertiary alcohols? Explain with reactions. (2 times)
Ans: (Text Book Page No:218)

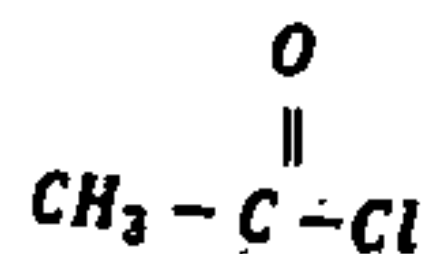
Topic No: 11.5.1

16. Write two methods for the preparation of phenol. How does phenol react with:i) Con. HNO_3 ii) Bromine water (7 times)
Ans: (Text Book Page No:219)
17. What is Dow's method for the preparation of Phenol? Explain acidic behaviour of phenol. (5 times)
Ans: (Text Book Page No:219)

Topic No: 11.5.5

18. How Phenol reacts with: (2 times)
i) Zn ii) NaOH iii) HNO_3 iv) H_2SO_4 v) bromine water
Ans: (Text Book Page No:221)
19. Write the chemical reaction of phenol with following.
(i) NaOH (ii) Zn (iii) CH_3COCl (iv) H_2
Ans: (Text Book Page No:220+221)
20. Describe any four chemical reactions of carbolic acid.
Ans: (Text Book Page No:221)
21. Write down two methods for preparing phenol. What is the reaction of phenol with i) Z_n ii) Br_2 water
Ans: (Text Book Page No:219)
22. Write reactions of phenol with (i) HNO_3/Δ (ii) H_2SO_4 (Conc) (iii) Br_2(iv) CH_3COCl
Ans: (Text Book Page No:221)

Topic No: 11.5.6

23. Give the reaction of phenol with:
(i) HNO_3 (ii) H_2SO_4 (iii) $CH_3-\overset{O}{\overset{\|}{C}}-Cl$
Ans: (Text Book Page No:221)
24. How will you convert ethane into (i) ethyl alcohol (ii) ethylene epoxide (iii) ethylene glycol (iv) ethylene chlorohydrins?
Ans: (Text Book Page No:154)
25. Convert phenol into : (i) Picric acid. (ii) Cyclohexanol. (iii) Bakelite.
ANs: (Text Book Page No:221)
26. How will you convert: (2 times)
i) Ethanol into Methanol
ii) Ethanol into Ethanol
iii) Ethanol into Ethene
iv) Ethanol into diethyl ether

Topic No: 11.6.2

27. Write structural formula of:
(i) Glycerol (ii) Carbolic acid (iii) Sodium Ethoxide (iv) Propoxy propane
Ans: (Text Book Page No:213)

OBJECTIVES (MCQ'S) OF CHAPTER- 12 ALDEHYDE AND KETONES ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 12.1

1. The carbon atom of a carbonyl group is: (3 times)
(a) sp-hybridized (b) sp^2-hybridized (c)benzoic acid (d) butanoic acid

Topic No: 12.2.1

2 Aldehydes react with hydroxylamine in acidic solution to give:
(a) An oxime (b) Aldol (c) Polymer (d) Acetic acid

Topic No: 12.3

3. Katones are prepared by the oxidation of: (2 times)
(a) Primary alcohol (b) Secondary alcohol (c) Tertiary alcohol (d)Polyhydric alcohol

Topic No: 12.4

4. Both aldehydes and ketones reacts with?
(a) Grignard reagent (b) Tollen's reagent (c) Fehling's reagent (d) Benedict's reagent
5.The carbon atom of a carbonyl group is : (4 times)
(a)sp-hybridized (b) sp^2-hybridized (c)sp^3-hybridized (d)sp-sp hybridized
6. The state of hybridization of carbon atom in HCHO is:
(a) dsp^2 (b) Sp^3 (c) Sp^2 (d) Sp

Topic No: 12.5.1

7. Acetone reacts with HCN to form a cyanohydrin. It is an example of: (3 times)
(a)Nucleophilic addition (b)Substitution reaction (c) Elimination reaction (d)None
8.Cannizzaro's reaction is not given by: (9 times)
(a) Formaldehyde (b) Acetaldehyde (c)Benzaldehyde (d)Trimethylacetaldehyde
9. Which compound will not give iodoform test on treatment with I_2 /NaOH? (6 times)
(a) Acetaldehyde (b) Acetone (c) Butanone (d) 3-pentanone
10- Cannizzaro's reaction is given by: (2 times)
(a) Acetaldehyde (b) Formaldehyde (c) Propanal (d) Propanone
11.Cannizzaro's reaction is not given by:
(a) HCHO (b) CHO (c)$(CH_3)_3C-CO-H$ (d) CH_3-CO-H
12.Addition of alcohol in carbonyl compounds gives acetal. The geometry of acetal is:
(a) Linear (b) Trigonal (c) Tetrahedral (d) Planer
13- Which reaction is disproportionation reaction?
(a) aldol condensation (b)Cannizzaro's reaction
(c)haloform reaction (d) acid catalysed reaction
14- Aldol Condensation is given by:
(A) Acetaldehyde (B) Formaldehyde (C) Benzaldehyde (D) Trimethylacetaldehyde

Topic No: 12.5.2

15. Methanol can be prepared from hydrogenation of:
(a) CH_3N (b) CH_3Br (c)HCHO (d)CH_3CHO
16. Formation of acetaldehyde from ethanol is known as:
(a) Reduction (b) Addition (c) Oxidation (d) Substitution
17. Aldehydes on reduction form:
(a) Primary alcohols (b) Secondary alcohols (c) Tertiary alcohol (d) Ketones

Topic No: 12.6

18. Which compound will react with Tollen's reagent? (2 times)
(a) Acetaldehyde (b) Acetone (c) Acetic acid (d) Butanone
19. In the given compounds which will react with Tollen's reagents?
(a) CH_3-OH (b) CH_3-CO-CH_3 (c) CH_3-CHO (d) CH_3-CH_2- CH_2-OH

20. Aldehydes and ketones can be detected by:
(a) 2,4-DNP test (b) Tolleh's test
(c) Sodium Nitropruside test (d) Benedicts solution test

21. Silver mirror test is given by:
(a) Ethers (b) Ketones (c) Acids (d) Aldehydes **(2 times)**

22- Which test is called silver mirror test?
(a) Tollen's test (b) Fehling's test
(c) Benedict's test (d) Sodium nitro preside test

23- Which of the following reagents will reacts with both aldehyde and ketones: **(12 times)**
(a) Tollen's reagent (b) Grignard's Reagent (c) Fehling's reagent (d) Benedict's Reagent

24- Which of the following compound will react with Benedict solution?
(a) $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$ (b) $CH_3-\overset{O}{\overset{\|}{C}}-H$
(c) $C_2H_5-\overset{O}{\overset{\|}{C}}-OH$ (d) CH_3-O-CH_3

25 Which of the following will react with Tollen'sreagent:
(a) $CH_3-\overset{O}{\overset{\|}{C}}-H$ (b) CH_3COCH_3 (c) CH_3COOH (d) $CH_3COC_2H_5$

Topic No: 12.7

26. Formaline is: **(2 times)**
(a) 10% solution of Formaldehyde in water (b) 20% solution of Formaldehyde in water
(c) 40% solution of Formaldehyde in water (d) 60% solution of Formaldehyde in water

27. Which of the following has highest boiling point: **(3 times)**
(a) methanal (b) ethanal (c) propanal (d) 2- hexanone

2019

28. The Carbon of Carbonyl Group is:
(a) Sp Hybridized (b) Sp^2 Hybridized (c) Sp^3 Hybridized (d) dSp^2 Hybridized

29. Which Reagent is used to reduce a Carboxylic Group to an Alcohol:
(a) H_2/Ni (b) H_2/Pt (c) $NaBH_4$ (d) $LiAH_4$

30. Which one of the following compounds will react with Fehling's solution?
(a) $HCOOH$ (b) $H_3C.CHO$ (c) H_3CCOOH (d) $H_3C-COCH_3$

31. Which of the following reagent will react with both aldehydes and Ketones:
(a) Tollen's reagent (b) Fehling reagent (c) Barford reagent (d) Grignard reagent

32. The reagent used to reduce carboxylic group into an alcohol is:
(a) H_2/Pt (b) H_2/Ni (c) $NaBH_4$ (d) $LiAlH_4$

33. Which of the following reagent will react with both aldehydes and Ketones:
(a) Tollen's reagent (b) Fehling reagent (c) Barford reagent (d) Grignard reagent

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
B	A	B	A	B	C	A	B	D	B	D	C	B	A
15	16	17	18	19	20	21	22	23	24	25	26	27	28
C	C	A	A	C	A	D	A	B	B	A	C	D	B
29	30	31	32	33									
D	B	D	D	D									

SHORT QUESTIONS OF CHAPTER- 12
ALDEHYDE AND KETONES
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 12.1

1. Write the functional group of aldehyde and ketone, give one example of each.

Ans: **Functional group of aldehyde and ketone:**

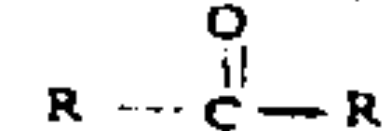
$-\overset{O}{\overset{\|}{C}}-H$, $\overset{O}{\overset{\|}{C}}$

Functional group of aldehyde Functional group of ketone:

2. What is the difference between aldehydes and ketones?

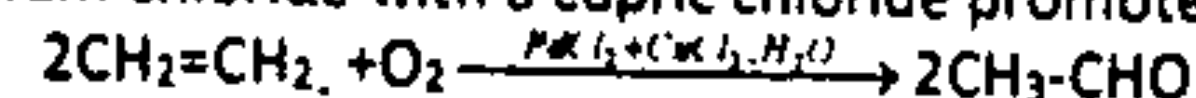
Ans: **Aldehydes:** In aldehydes, the carbonyl group is bonded to atleast one hydrogen atom, and so it occurs at the end of a chain. An aldehyde can be represented by the general formula $R-\overset{O}{\overset{\|}{C}}-H$. Where R may be H or an alkyl group.

Ketones: In ketones, the carbonyl group is bonded to two carbon atoms, and so it occurs within a chain. A ketone may be represented by the general formula.

$R-\overset{O}{\overset{\|}{C}}-R$.

Topic No: 12.3

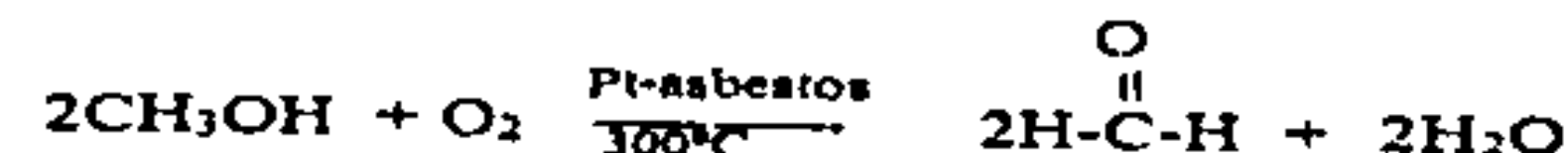
3 Give industrial preparation of acetaldehydes? **(4 times)**

Ans: Acetaldehyde is prepared industrially by air oxidation of ethylene using palladium chloride with a cupric chloride promoter.

$$2CH_2=CH_2 + O_2 \xrightarrow{PdCl_2+CuCl_2,H_2O} 2CH_3-CHO$$

Ethylene Acetaldehyde

4 Explain one method of formation of formaldehyde from methyl alcohol.

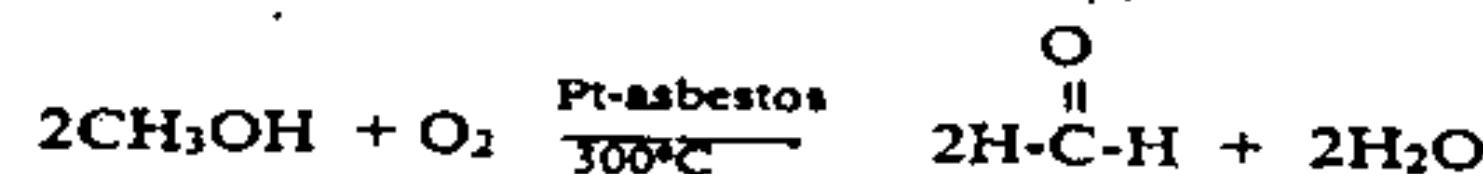
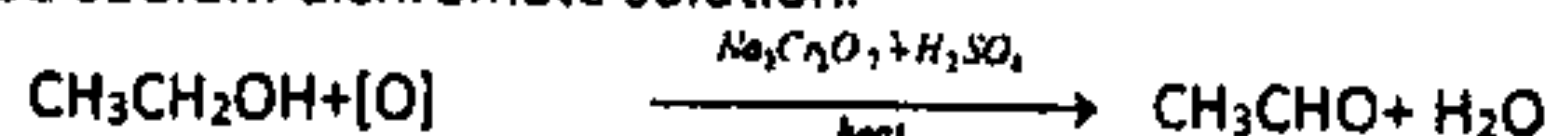
Ans: Formaldehyde is prepared in laboratory by passing a mixture of methyl alcohol vapours and air over platinized asbestos or copper or silver catalyst at 300 °C.

$$2CH_3OH + O_2 \xrightarrow[300°C]{Pt\text{-}asbestos} 2H-\overset{O}{\overset{\|}{C}}-H + 2H_2O$$

5 Write methods to prepare formaldehyde and acetaldehyde?(2 times)

Ans: **Formaldehyde** is prepared in laboratory by passing a mixture of methyl alcohol vapours and air over platinized asbestos or copper or silver catalyst at 300°C.

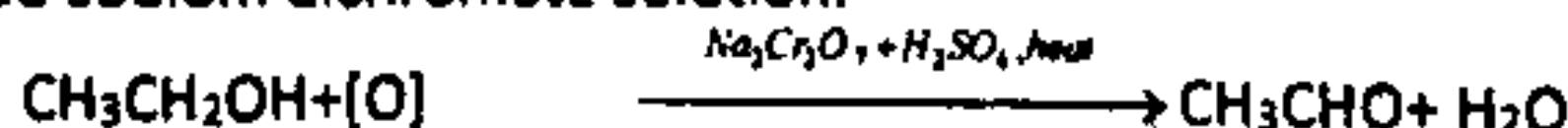
$$2CH_3OH + O_2 \xrightarrow[300°C]{Pt\text{-}asbestos} 2H-\overset{O}{\overset{\|}{C}}-H + 2H_2O$$

Acetaldehyde is prepared in laboratory by the oxidation of ethyl alcohol with acidified sodium dichromate solution.

$$CH_3CH_2OH+[O] \xrightarrow[heat]{Na_2Cr_2O_7+H_2SO_4} CH_3CHO+H_2O$$

A mixture of ethyl alcohol and sodium dichromate solution is run into boiling dilute sulphuric acid. Immediately a vigorous reaction takes place and the acetaldehyde formed in liquid state in immediately distilled off. This prevents the oxidation of acetaldehyde to acetic acid, Ethyl alcohol remains in solution until it is oxidized. Pure acetaldehyde is obtained by recrystallization.

6 How acetaldehyde is prepared from ethyl alcohol in the laboratory? (2 times)

Ans: Acetaldehyde is prepared in laboratory by the oxidation of ethyl alcohol with acidified sodium dichromate solution.

$$CH_3CH_2OH+[O] \xrightarrow{Na_2Cr_2O_7+H_2SO_4,heat} CH_3CHO+H_2O$$

A mixture of ethyl alcohol and sodium dichromate solution is run into boiling dilute sulphuric acid. Immediately a vigorous reaction takes place and the

acetaldehyde formed in liquid state in immediately distilled off. This prevents oxidation of acetaldehyde to acetic acid. Ethyl alcohol remains in solution un: is oxidized. Pure acetaldehyde is obtained by recrystallization.

7 Write down mechanism of Cannizzaro's reaction?

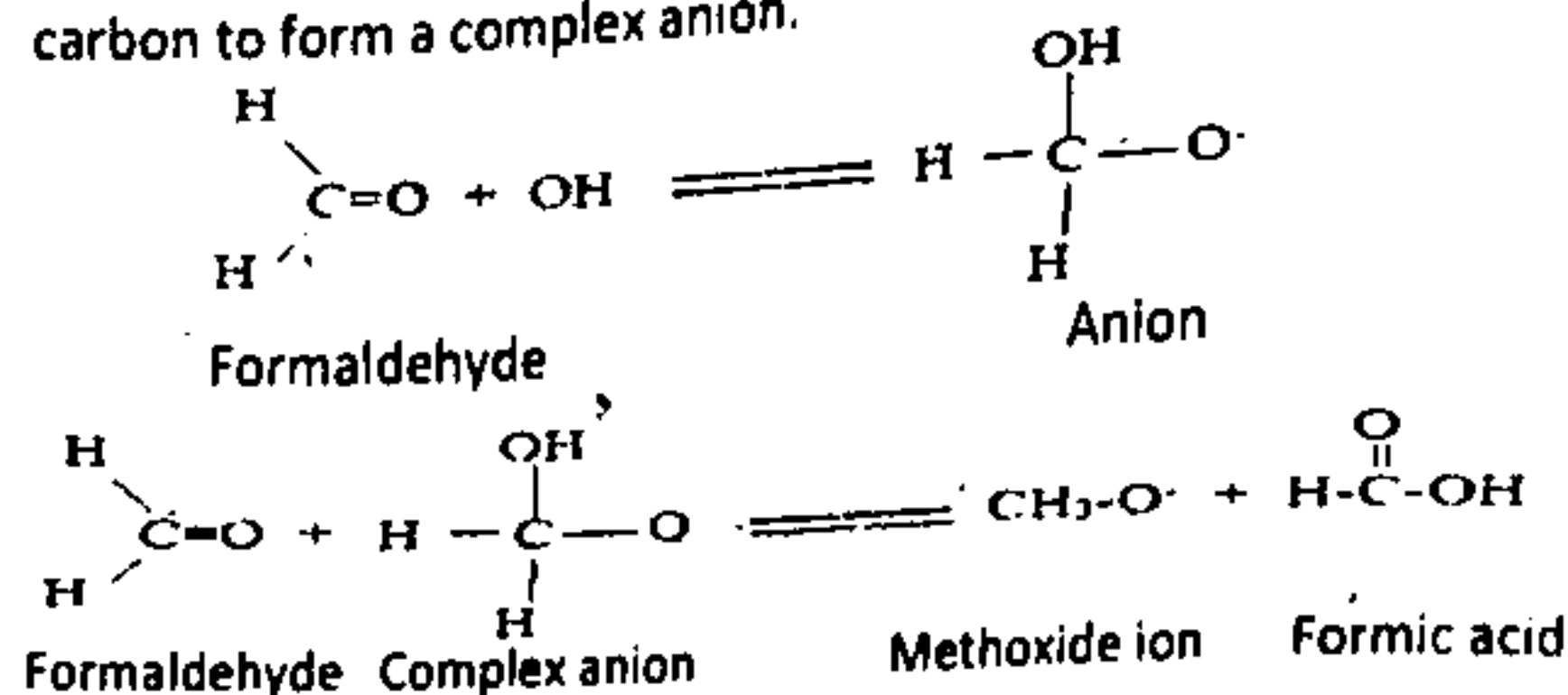
Ans: The hydroxid ion act as a nucleophile. It attacks on the electrophile carbo carbon to form a complex anion.

$$H_2C{=}O + OH^- \rightleftharpoons H-\underset{H}{\overset{OH}{C}}-O^-$$

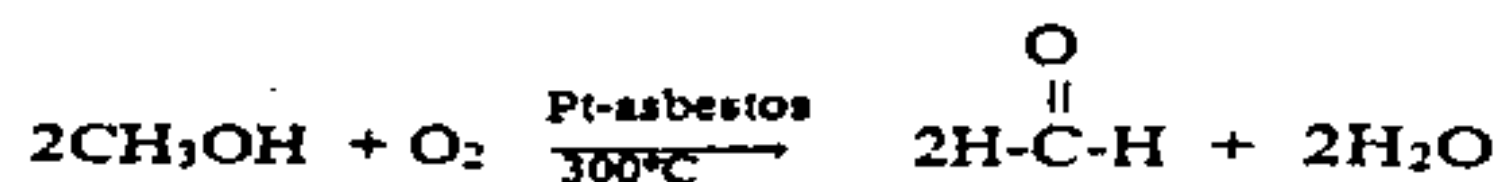
Formaldehyde Anion

$$H_2C{=}O + H-\underset{H}{\overset{OH}{C}}-O \rightleftharpoons CH_3\text{-}O^- + H\text{-}\overset{O}{\overset{\|}{C}}\text{-}OH$$

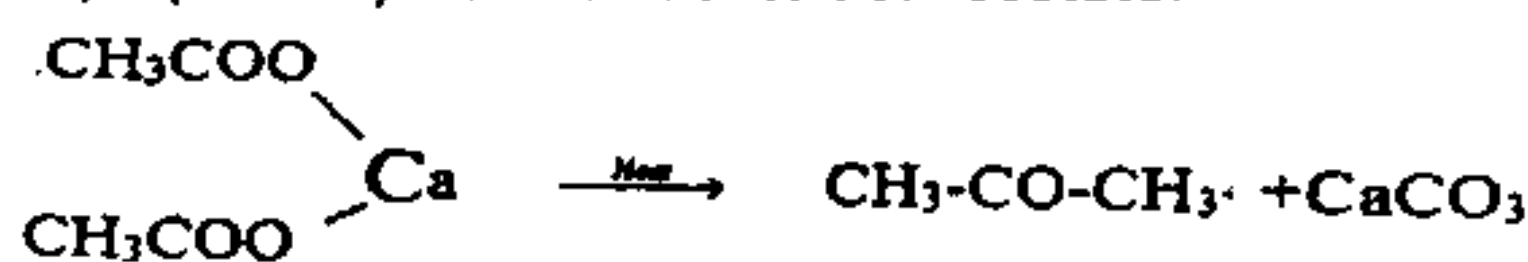
Formaldehyde Complex anion Methoxide ion Formic acid

$$CH_3-O^- + \overset{\delta+}{H}-\overset{\delta-}{O}-\overset{O}{\overset{\|}{C}}-H \rightarrow CH_3OH + H-\overset{O}{\overset{\|}{C}}-O^- \xrightarrow{NaOH} H-\overset{O}{\overset{\|}{C}}-O^-Na^+ + OH$$

8. How formaldehyde is prepared on industrial scale? **(5 times)**

Ans: Formaldehyde is manufactured by passing a mixture of methanol vapours and over iron oxide-molybdenum oxide or silver catalyst at 500 °C.

$$2CH_3OH + O_2 \xrightarrow[300°C]{Pt\text{-}asbestos} 2H\text{-}\overset{O}{\overset{\|}{C}}\text{-}H + 2H_2O$$

9. PrepareAcetone from Calcium Acetate. **(4 times)**

Ans: Acetone is prepared by distillation of calcium acetate.

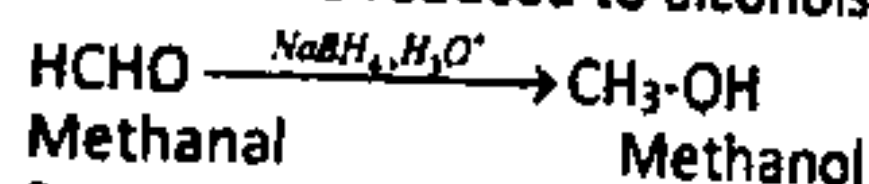
$$(CH_3COO)_2Ca \xrightarrow{heat} CH_3\text{-}CO\text{-}CH_3 + CaCO_3$$

Topic No: 12.5

10 Convert : Methanal ⟶ Methanol, Propanone to 2-propanol?

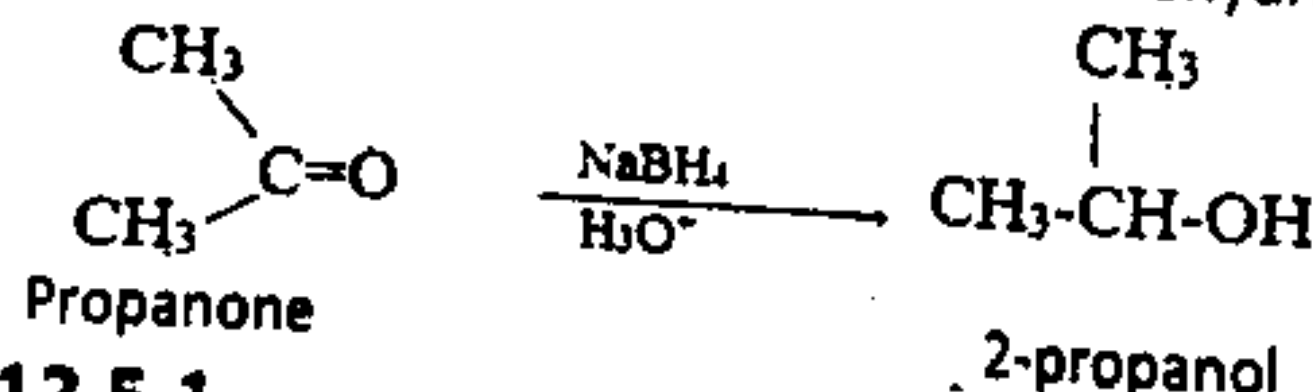
Ans: **Conversion of Methanal to Methanol, Propane to 2-propanol**

i. Methanal is reduced to alcohols with sodium borohydride, $NaBH_4$.

$$HCHO \xrightarrow{NaBH_4, H_3O^+} CH_3\text{-}OH$$

Methanal Methanol

ii. Propanone is reduced to alcohols with sodium borohydride, $NaBH_4$.

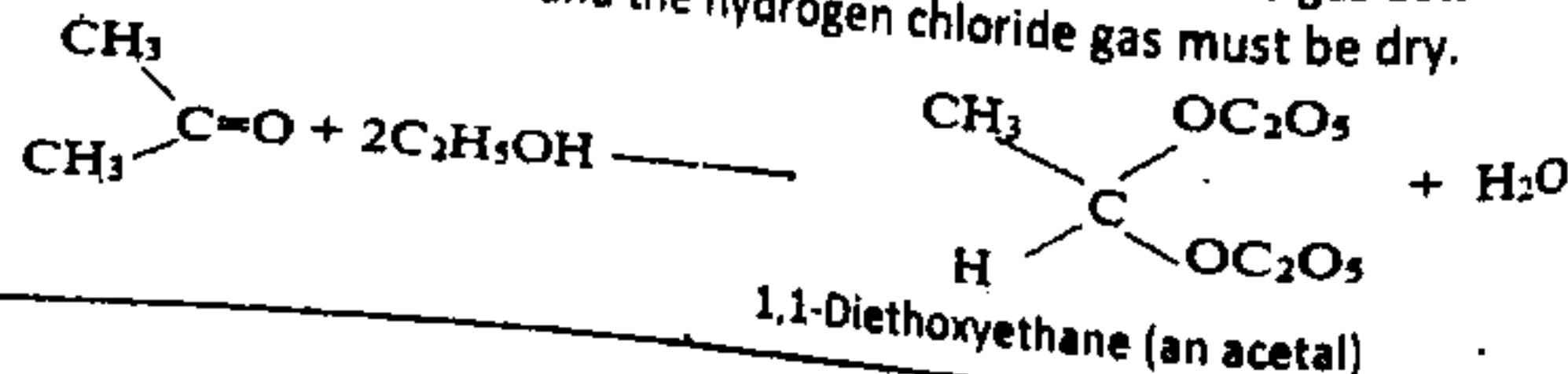
$$(CH_3)_2C{=}O \xrightarrow[H_3O^+]{NaBH_4} CH_3\text{-}\overset{CH_3}{\overset{|}{C}H}\text{-}OH$$

Propanone 2-propanol

Topic No: 12.5.1

11 How acetals are formed? **(2 times)**

Ans: **Formation of acetals:-**Acetaldehyde combine with alcohols in the presence of hydrogen chloride gas to form acetals. The hydrogen chloride gas acts as a catalyst. Both the alcohol and the hydrogen chloride gas must be dry.

$$(CH_3)(CH_3)C{=}O + 2C_2H_5OH \longrightarrow CH_3(H)C(OC_2O_5)_2 + H_2O$$

1,1-Diethoxyethane (an acetal)

12 Addition of HCN on aldehydes and ketones is a base catalyzed reaction? **(2 times)**

Ans: Hydrogen cyanide adds to aldehydes and ketones to form cyanohydrins. The reaction is carried out by adding slowly a mineral acid to an aqueous solution of sodium cyanide. The acid generates HCN from sodium cyanide in situ.

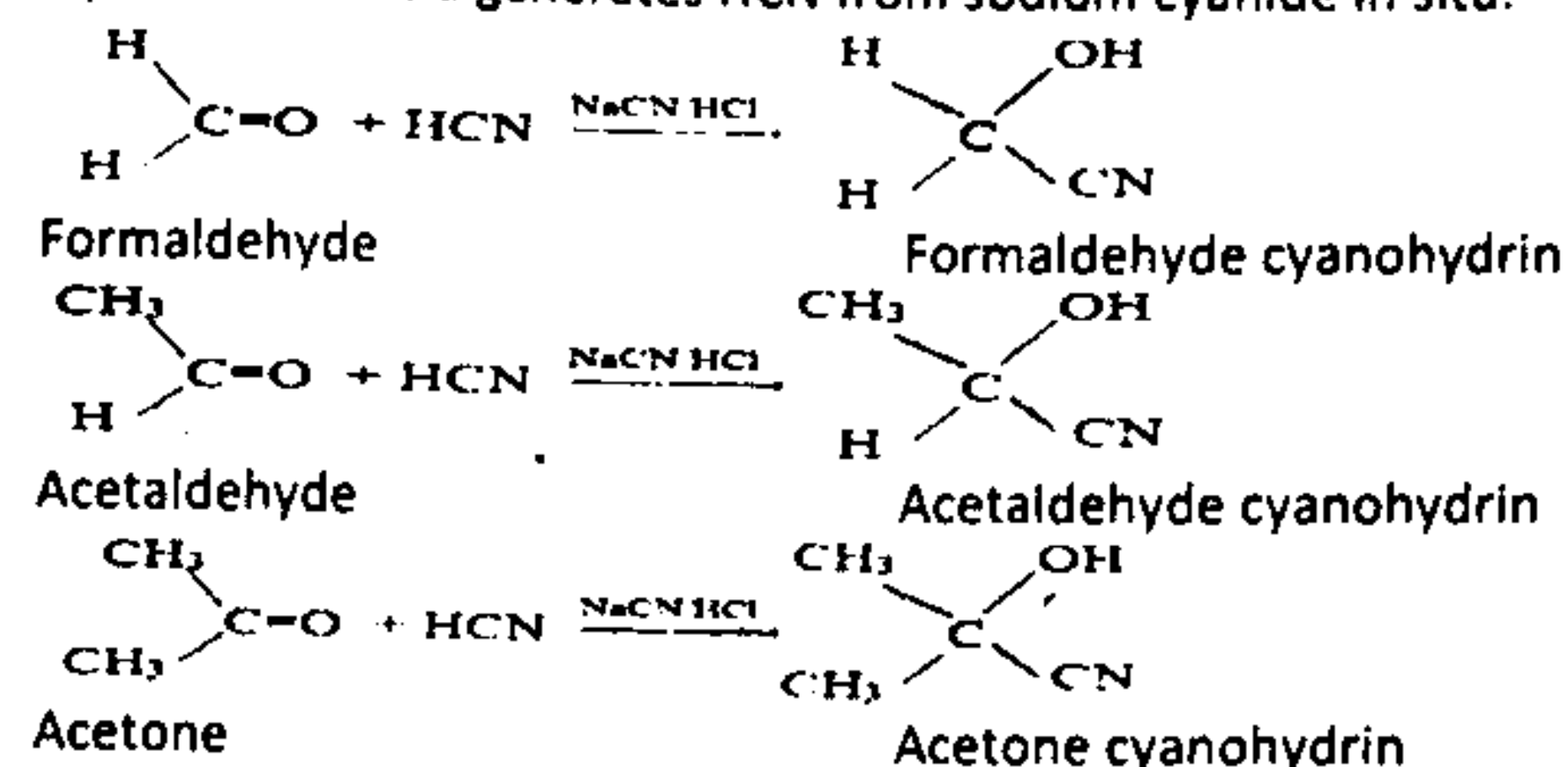
$$H_2C{=}O + HCN \xrightarrow{NaCN/HCl} H_2C(OH)(CN)$$

Formaldehyde Formaldehyde cyanohydrin

$$CH_3(H)C{=}O + HCN \xrightarrow{NaCN/HCl} CH_3(H)C(OH)(CN)$$

Acetaldehyde Acetaldehyde cyanohydrin

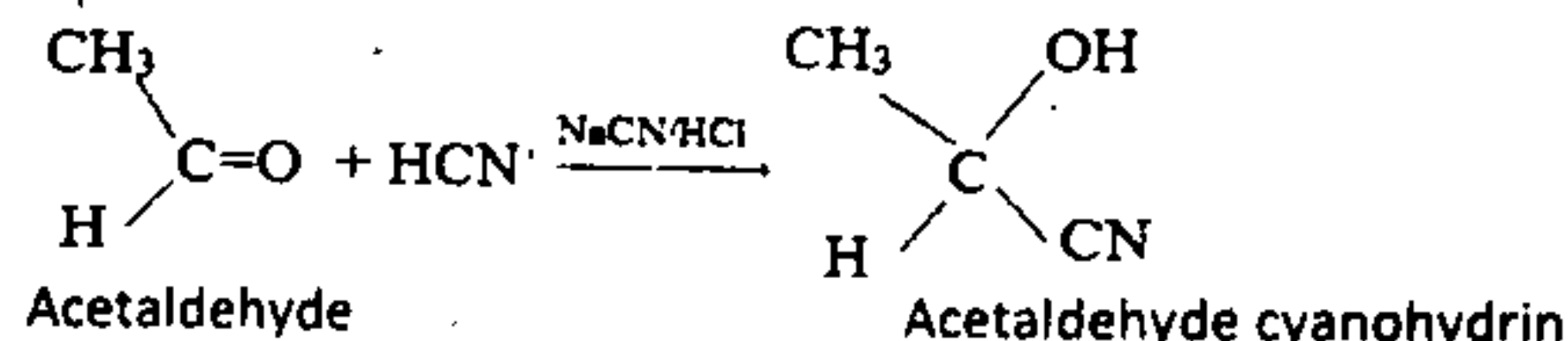
$$(CH_3)_2C{=}O + HCN \xrightarrow{NaCN/HCl} (CH_3)_2C(OH)(CN)$$

Acetone Acetone cyanohydrin

13 Define nucleophilic addition reaction with an example? **(2 times)**

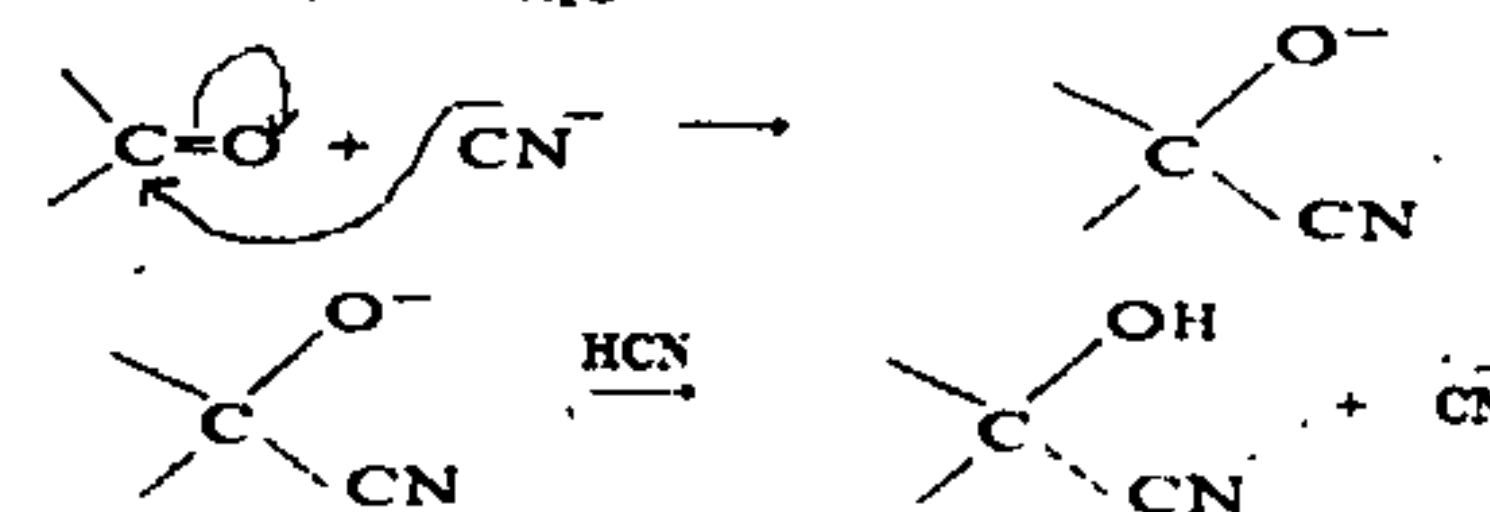
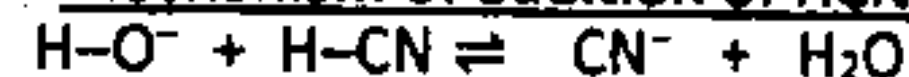
Ans: **Nucleophilic addition reaction:-**Addition of nucleophilic reagent to the substrate (aldehyde or ketone) in the presence of some catalyst is called nucleophilic addition reaction. It is due to the unsymmetrical electronic distribution about the carbonyl group, the nucleophilic reagent can start the initial attack on the carbon.

For example:

$$CH_3(H)C{=}O + HCN \xrightarrow{NaCN/HCl} CH_3(H)C(OH)(CN)$$

Acetaldehyde Acetaldehyde cyanohydrin

CN^- acts as nucleophile. It attacks on the carbonyl carbon and convert acetaldehyde to acetaldehyde cyanohydrin.

14. Give the mechanism of addition of HCN to Acetone.

Ans: **Mechanism of addition of HCN to Acetone:**

$$H\text{–}O^- + H\text{–}CN \rightleftharpoons CN^- + H_2O$$

$$>C{=}O + CN^- \longrightarrow >C(O^-)(CN)$$

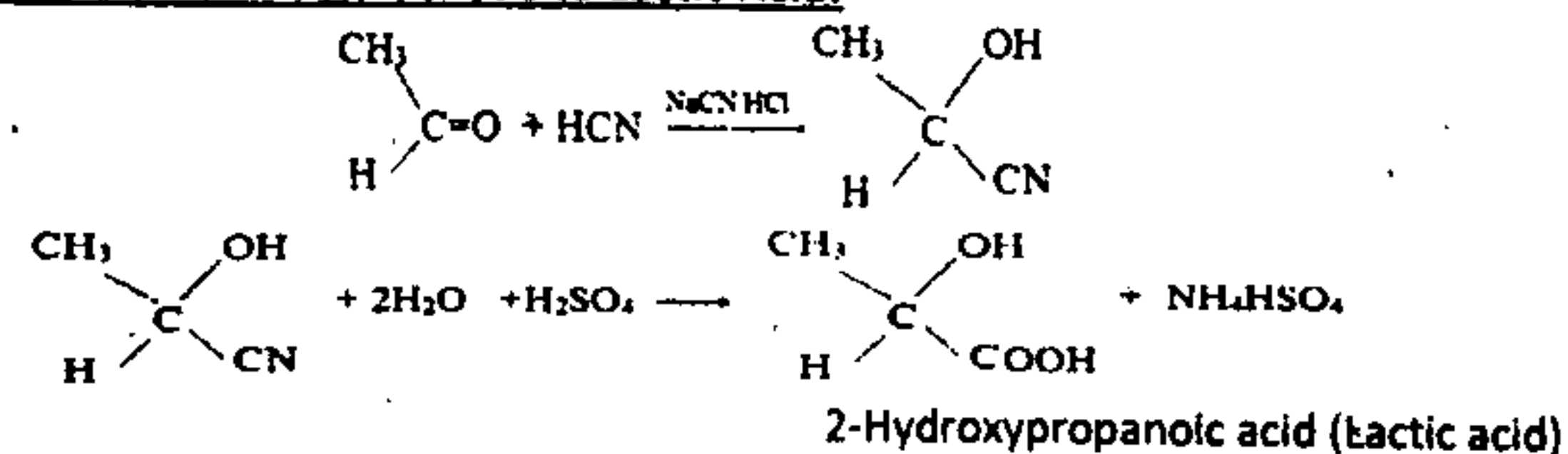
$$>C(O^-)(CN) \xrightarrow{HCN} >C(OH)(CN) + \overline{CN}$$

15. Convert Acetaldehyde to Lactic Acid. **(3 times)**

Ans: **Conversion of Acetaldehyde to Lactic Acid:**

$$CH_3(H)C{=}O + HCN \xrightarrow{NaCN/HCl} CH_3(H)C(OH)(CN)$$

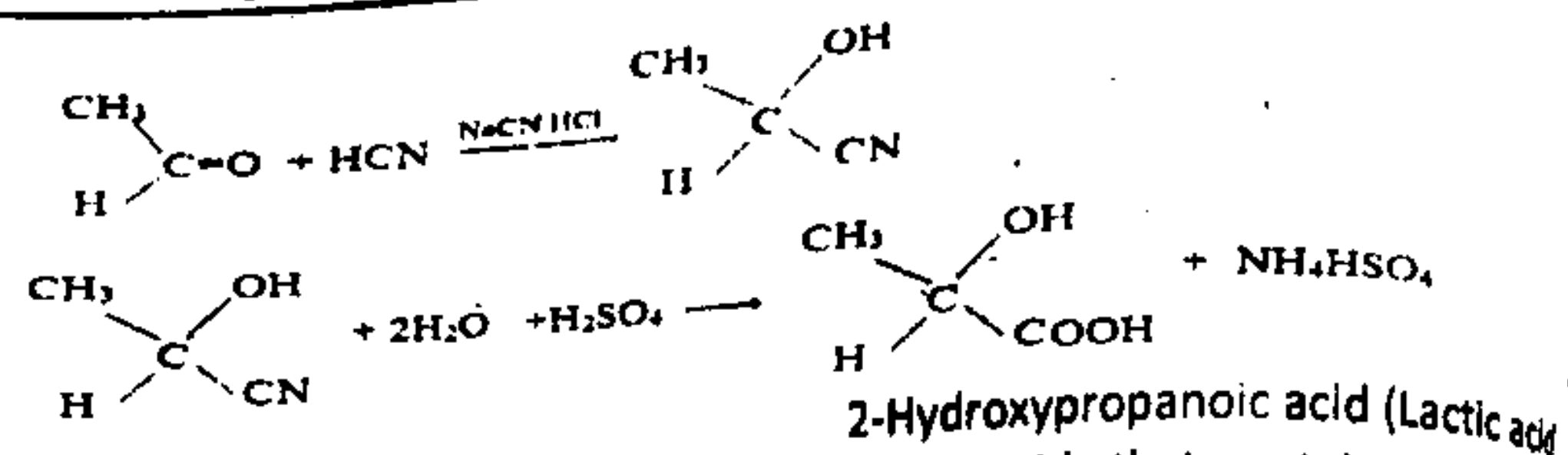
$$CH_3(H)C(OH)(CN) + 2H_2O + H_2SO_4 \longrightarrow CH_3(H)C(OH)(COOH) + NH_4HSO_4$$

2-Hydroxypropanoic acid (Lactic acid)

16. How α – *hydroxy* acid is prepared from aldehydes?

Ans: **Preparation of α – *hydroxy* acid from aldehydes:**

$$CH_3(H)C{=}O + HCN \xrightarrow{NaCN/HCl} CH_3(H)C(OH)(CN)$$

$$CH_3(H)C(OH)(CN) + 2H_2O + H_2SO_4 \longrightarrow CH_3(H)C(OH)(COOH) + NH_4HSO_4$$

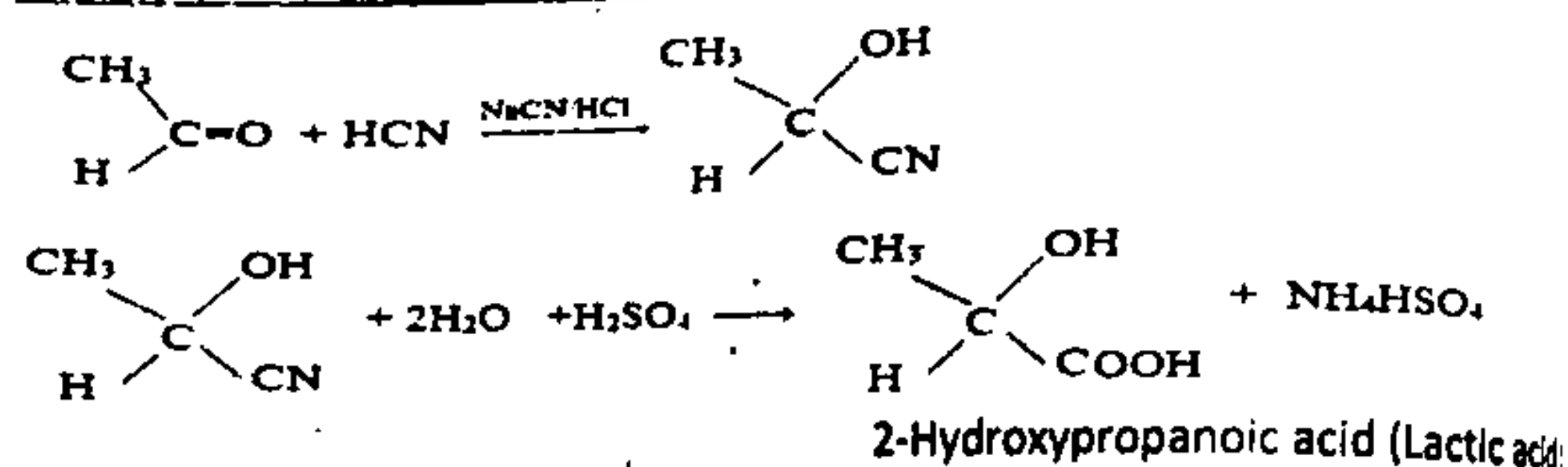
2-Hydroxypropanoic acid (Lactic acid)

This reaction is used in the synthesis of α-hydroxy acids that contain one carbon atom more than the number of carbon atoms in the starting aldehydes or ketones.

17. **Prepare lactic acid from acetaldehyde.**

Ans: **Preparation of lactic acid from acetaldehyde:**

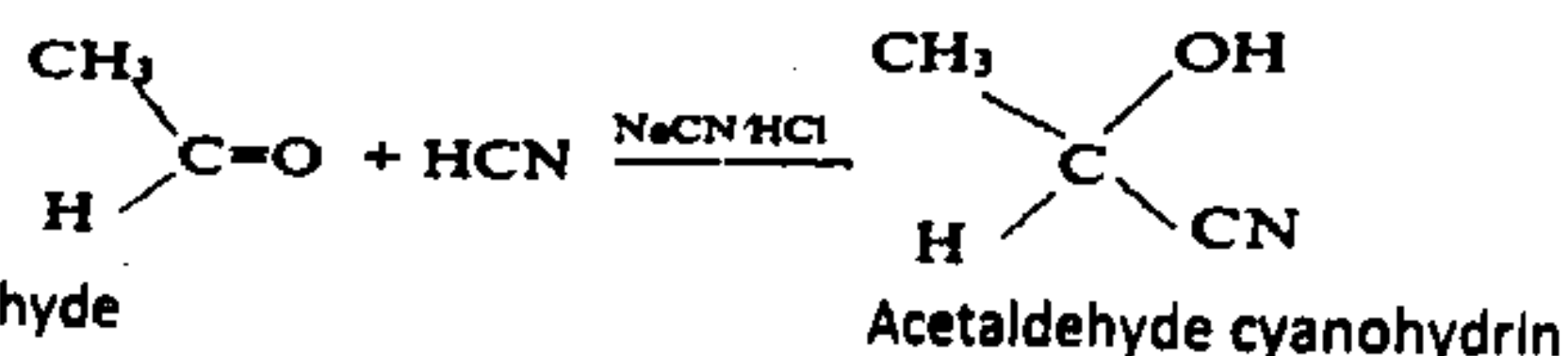
$$CH_3(H)C{=}O + HCN \xrightarrow{NaCN/HCl} CH_3(H)C(OH)(CN)$$

$$CH_3(H)C(OH)(CN) + 2H_2O + H_2SO_4 \longrightarrow CH_3(H)C(OH)(COOH) + NH_4HSO_4$$

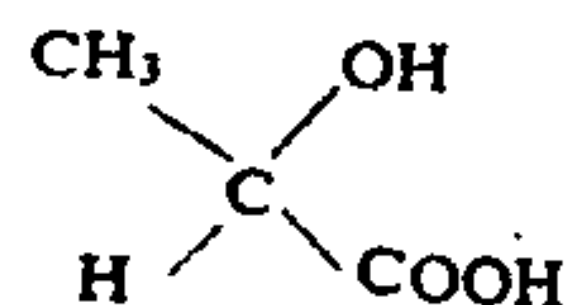
2-Hydroxypropanoic acid (Lactic acid)

18. **Give reaction of acetaldehyde with : HCN**

Ans: **HCN:**

$$CH_3(H)C{=}O + HCN \xrightarrow{NaCN/HCl} CH_3(H)C(OH)(CN)$$

Acetaldehyde → Acetaldehyde cyanohydrin

19. **Draw the structure of Lactic Acid.**

Ans: **Structure of Lactic Acid:**

$$CH_3(H)C(OH)(COOH)$$

Topic No: 12.5.1/3

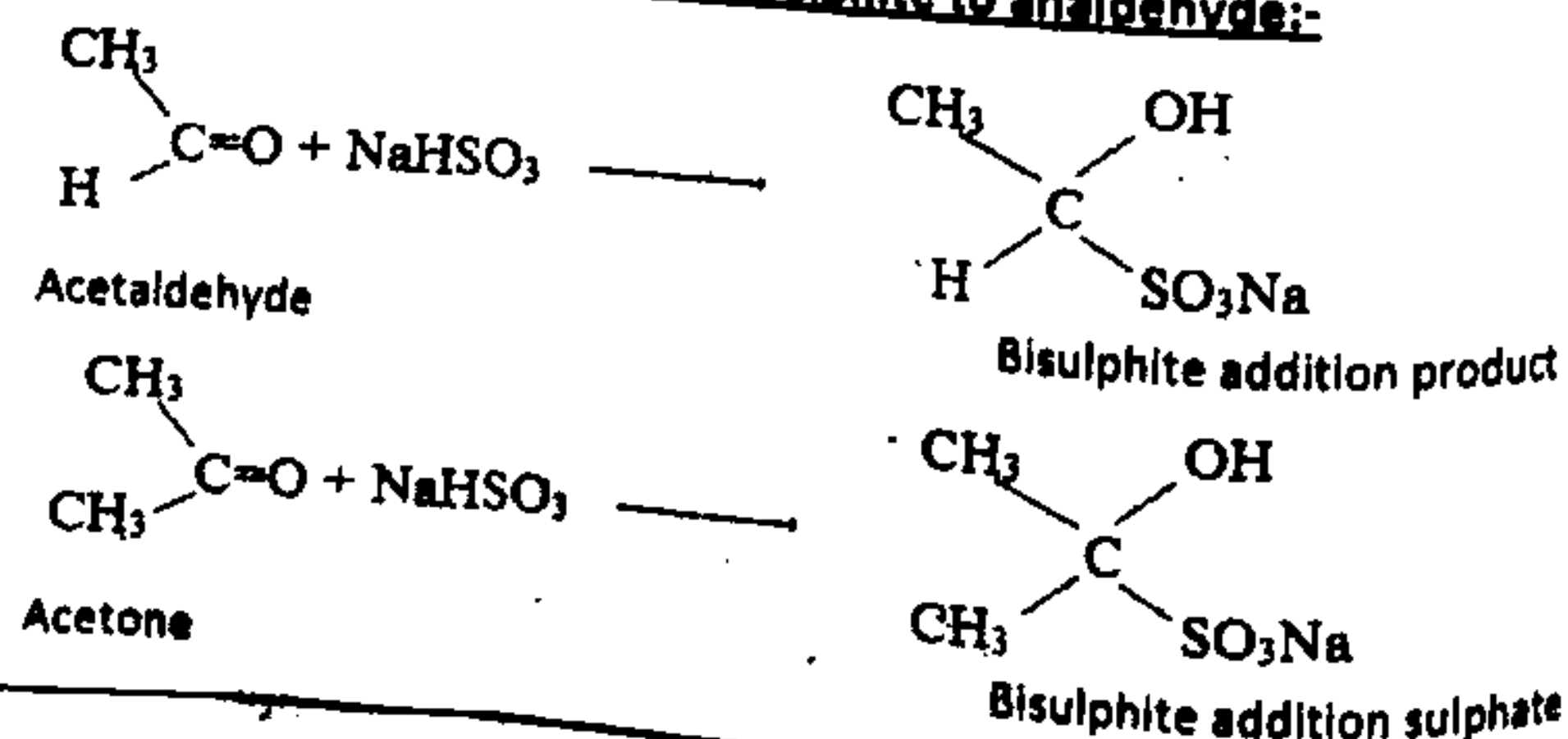
20 **Write the mechanism of the addition of sodiumbisulphite to analdehyde.**

Ans: **Mechanism of the addition of sodiumbisulphite to analdehyde:-**

$$CH_3(H)C{=}O + NaHSO_3 \longrightarrow CH_3(H)C(OH)(SO_3Na)$$

Acetaldehyde → Bisulphite addition product

$$CH_3(CH_3)C{=}O + NaHSO_3 \longrightarrow CH_3(CH_3)C(OH)(SO_3Na)$$

Acetone → Bisulphite addition sulphate

21 **Give mechanism of addition of HCN to acetaldyde.**

Ans:

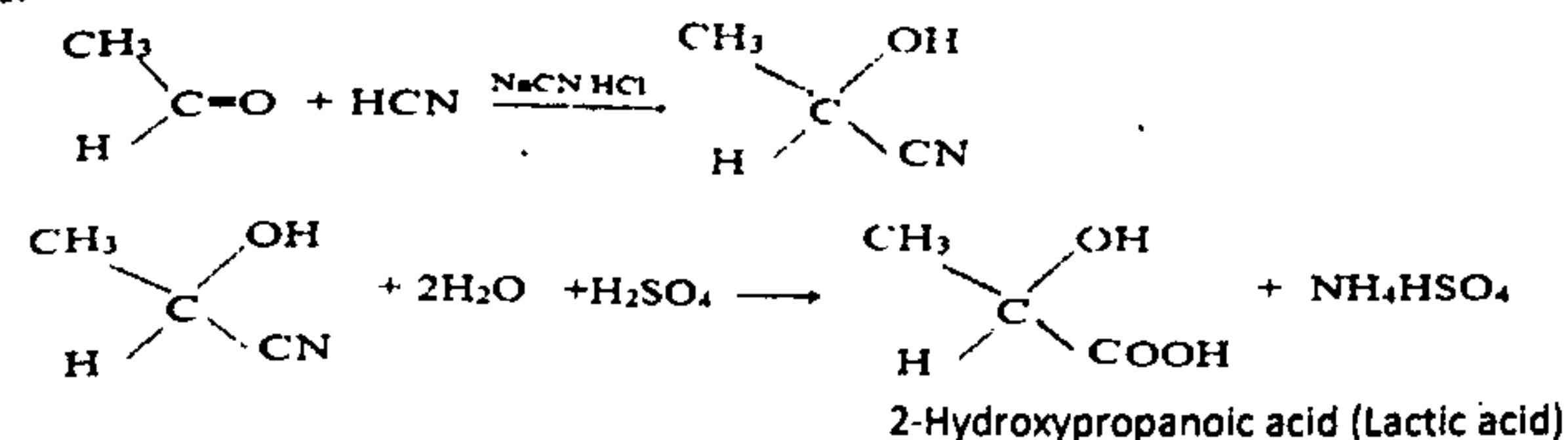
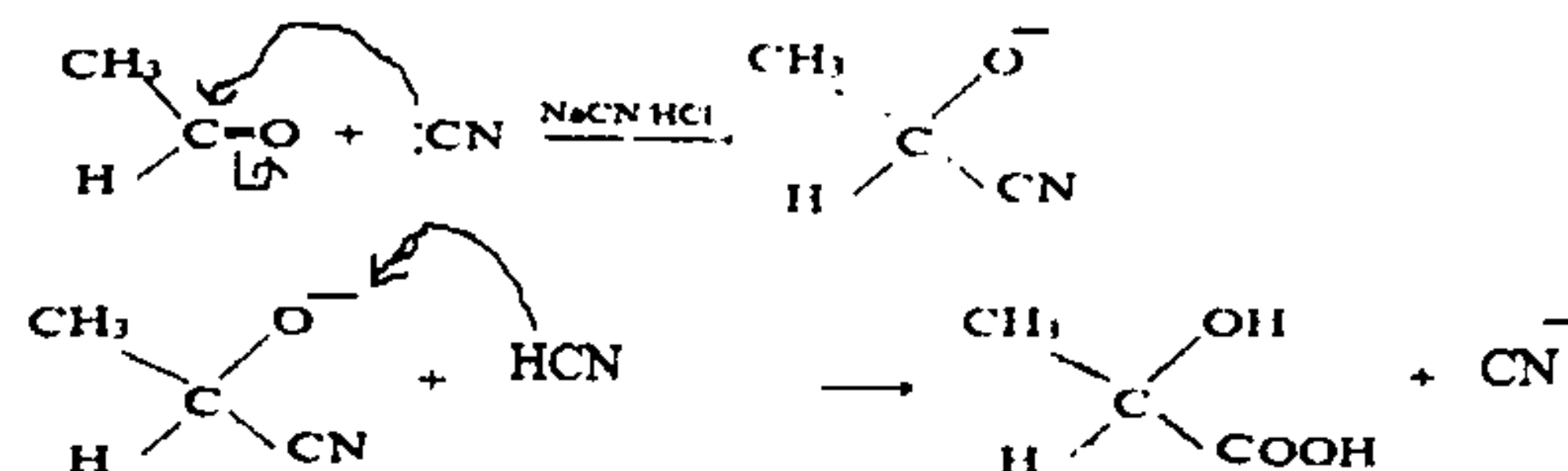
$$CH_3(H)C{=}O + HCN \xrightarrow{NaCN/HCl} CH_3(H)C(OH)(CN)$$

$$CH_3(H)C(OH)(CN) + 2H_2O + H_2SO_4 \longrightarrow CH_3(H)C(OH)(COOH) + NH_4HSO_4$$

2-Hydroxypropanoic acid (Lactic acid)

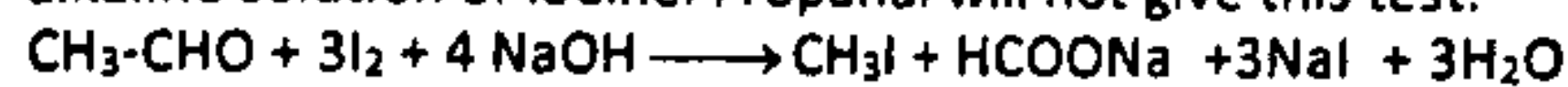
Mechanism:

$$CH_3(H)C{=}O + {:}CN^- \xrightarrow{NaCN/HCl} CH_3(H)C(O^-)(CN)$$

$$CH_3(H)C(O^-)(CN) + HCN \longrightarrow CH_3(H)C(OH)(COOH) + CN^-$$

Topic No: 12.5.1/4

22 **How will you distinguish between ethanal and propanal?** **(2 times)**

Ans: **Ethanal and propanal:-** Ethanal forms yellow precipitate of iodoform with an alkaline solution of iodine. Propanal will not give this test.

$$CH_3\text{-}CHO + 3I_2 + 4\,NaOH \longrightarrow CHI_3 + HCOONa + 3NaI + 3H_2O$$

23 **Define Aldol condensation?**

Ans: **Aldol condensation:-** Aldehydes and ketones possessing α-hydrogen atoms react with a cold dilute solution of an alkali to form addition products known as aldols. The name 'aldol' is given to the product because it contains both aldehyde and alcohol functional groups. In this process two molecules of the same carbonyl compound condense to form an aldol.

24 **How does acetaldehyde react with give reagents: (i)dilute NaOH (ii) NH₂OH** **(2 times)**

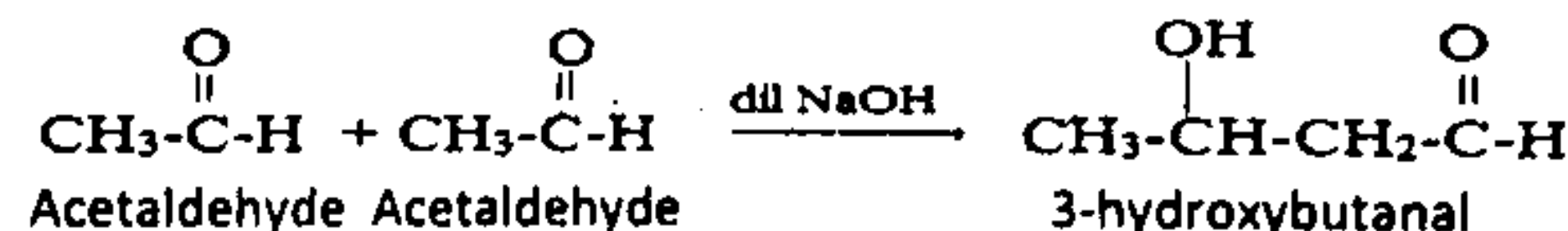
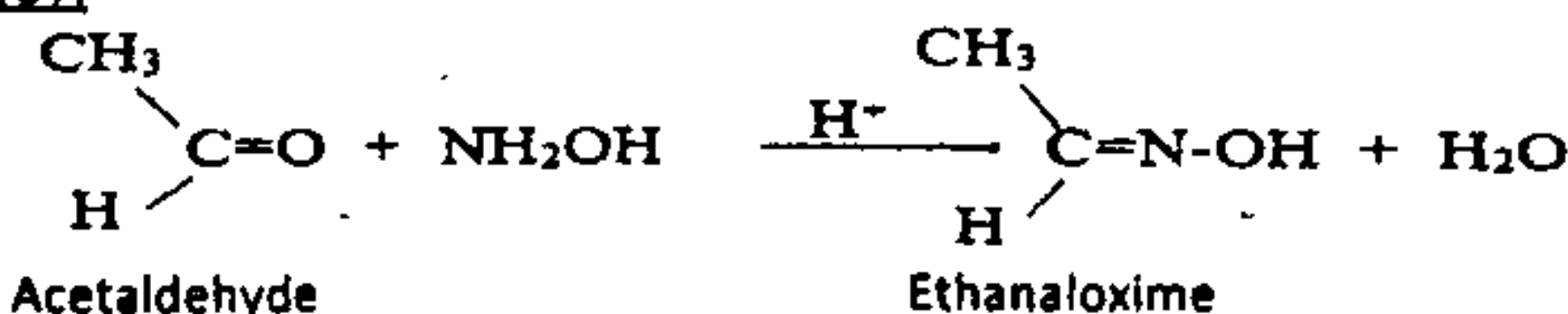
Ans: **(i)dilute NaOH :**

$$CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}H + CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}H \xrightarrow{dil\ NaOH} CH_3\text{-}\overset{OH}{\overset{|}{C}H}\text{-}CH_2\text{-}\overset{O}{\overset{\|}{C}}\text{-}H$$

Acetaldehyde + Acetaldehyde → 3-hydroxybutanal

(ii) NH_2OH

$$CH_3(H)C{=}O + NH_2OH \xrightarrow{H^+} CH_3(H)C{=}N\text{-}OH + H_2O$$

Acetaldehyde → Ethanaloxime

25 **What is iodoform test? Illustrate with an example.** **(2 times)**

Ans: **Iodoform test:-** The haloform reaction using iodine and aqueous sodium hydroxide is called the iodoform test. It results in the formation of water insoluble iodofrom which is a yallow solid. Iodoform test is used for distinguish methyl ketones from other ketones. It is also used to distinguish ethanol from methanol and other primary alcohols. It can be used to distinguish acetaldehyde from other aldehydes.

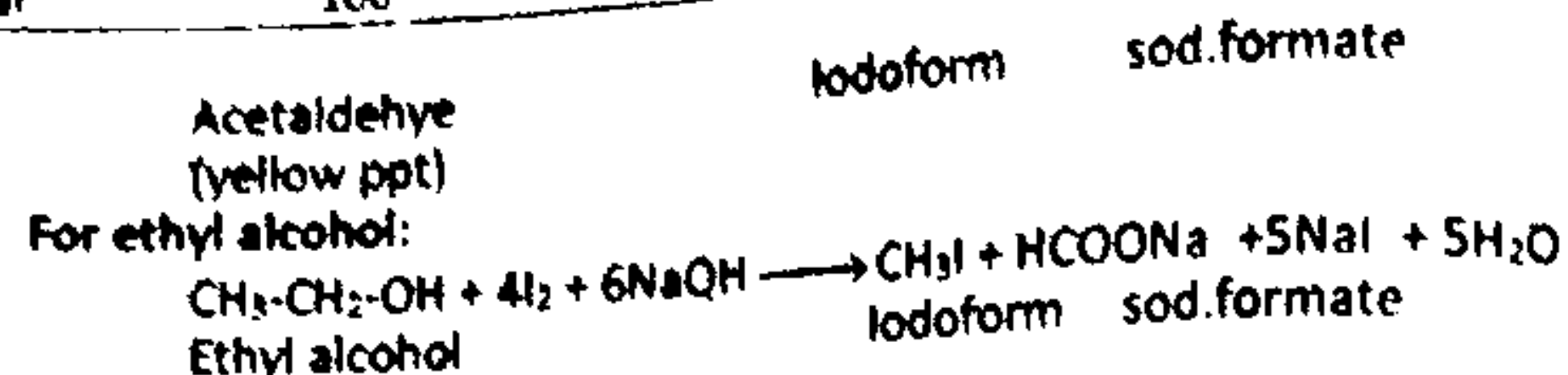
For Aectaldehyde:

$$CH_3\text{-}CHO + 3I_2 + 4\,NaOH \longrightarrow CHI_3 + HCOONa + 3NaI + 3H_2O$$

Acetaldehye (yellow ppt) Iodoform sod.formate

For ethyl alcohol:

$CH_3\text{-}CH_2\text{-}OH + 4I_2 + 6NaOH \longrightarrow CH_3I + HCOONa + 5NaI + 5H_2O$

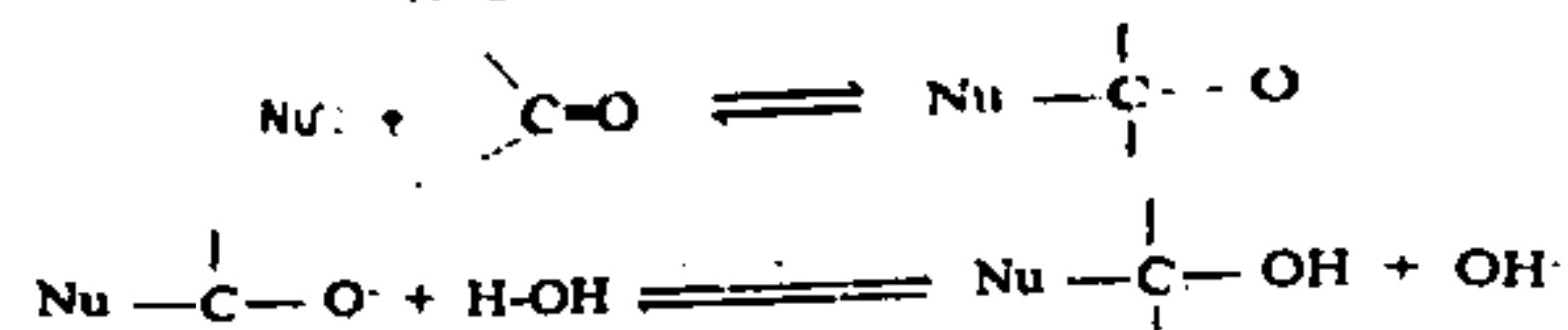
Ethyl alcohol Iodoform sod.formate

Topic No: 12.5.1/A

26 Describe briefly the mechanism of base catalyzed nucleophilic addition to carbonyl compound? (3 times)

Ans: A base catalyzed nucleoopnilic addition reaction will take place with a strong nucleophilic reagent which has general mechanism as:

$$H\text{-}O^- + H\text{-}Nu \rightleftharpoons Nu^-: + HOH$$

$$Nu^-: + \;>C{=}O \rightleftharpoons Nu - \overset{|}{\underset{|}{C}} - O^-$$

$$Nu - \overset{|}{\underset{|}{C}} - O^- + H\text{-}OH \rightleftharpoons Nu - \overset{|}{\underset{|}{C}} - OH + OH^-$$

27 How iodoform is prepared from acetaldehyde and ethyl alcohol?(2 times)

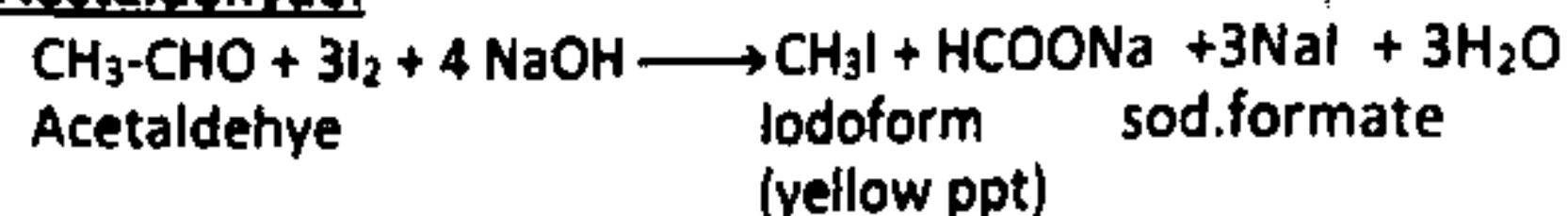
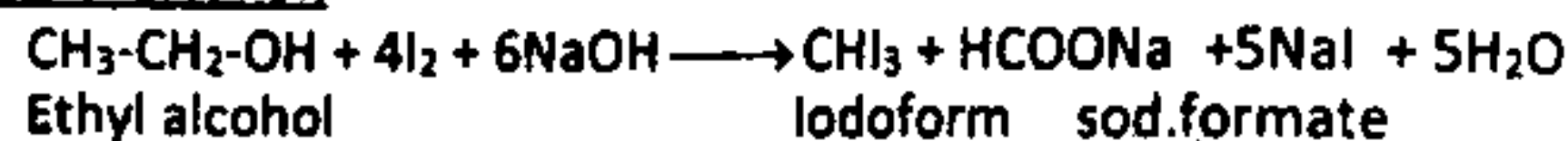
Ans: **From Aectaldehyde:**

$CH_3\text{-}CHO + 3I_2 + 4\,NaOH \longrightarrow CH_3I + HCOONa + 3NaI + 3H_2O$

Acetaldehye Iodoform (yellow ppt) sod.formate

From ethyl alcohol:

$CH_3\text{-}CH_2\text{-}OH + 4I_2 + 6NaOH \longrightarrow CHI_3 + HCOONa + 5NaI + 5H_2O$

Ethyl alcohol Iodoform sod.formate

28 Explain why the aldehydes with no a-hydrogen give Cannizzaro's reaction? (2 times)

Ans: In the absence of α-hydrogen aldehyde consist of only one carbon atom in the molecule. The attacking nucleophile cannot attack on hydrogen rather it will attack on the carbon having partial positive charge. Reaction thus proceed following Cannizzaro's mechanism rather than aldol condensation. Cannizzaro's reaction is a disproportionation (self oxidation and reduction) reaction. Two molecules of the aldehyde are involved, one molecule being converted into the corresponding alcohol (the reduced product) and the other into the acid in the salt form (the oxidation product).

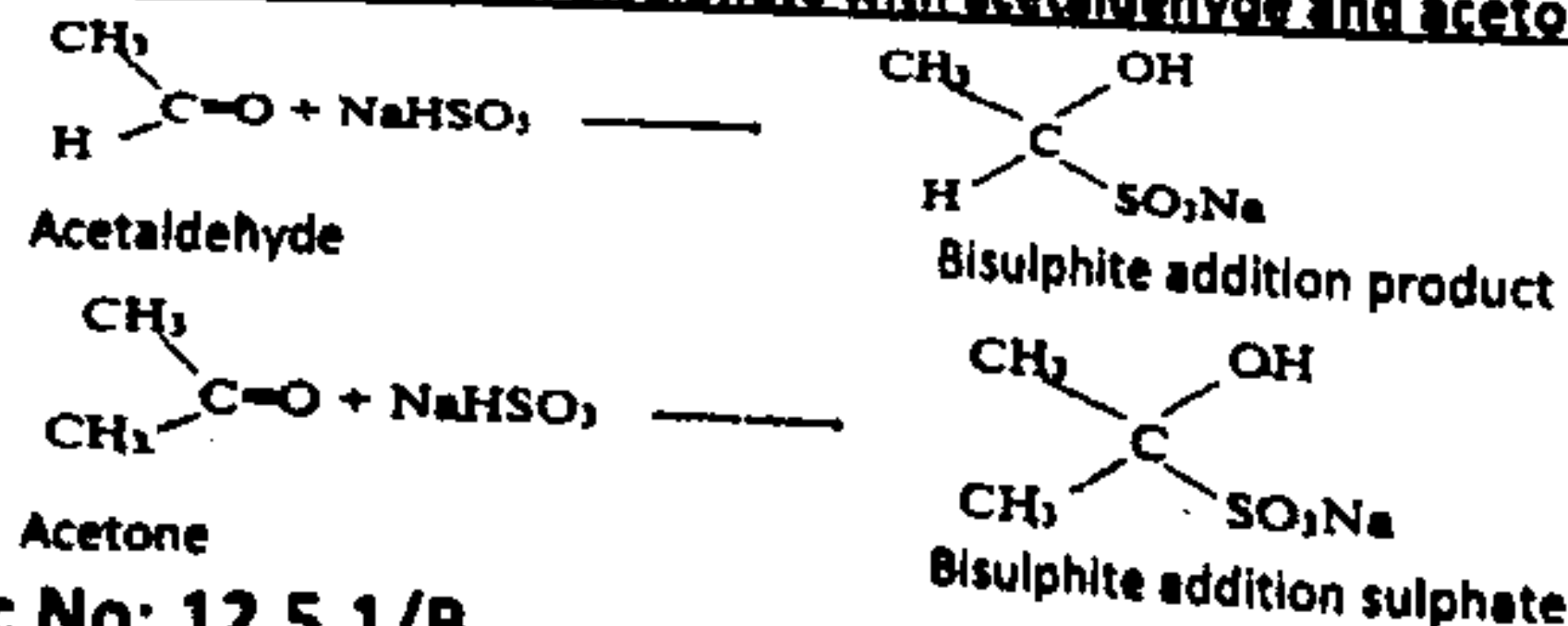
29 Write down reactions of sodium bisulphate with acetaldehyde and acetone?

Ans: **Reactions of sodium bisulphate with acetaldehyde and acetone:-**

$(CH_3)(H)C{=}O + NaHSO_3 \longrightarrow (CH_3)(H)C(OH)(SO_3Na)$

Acetaldehyde — Bisulphite addition product

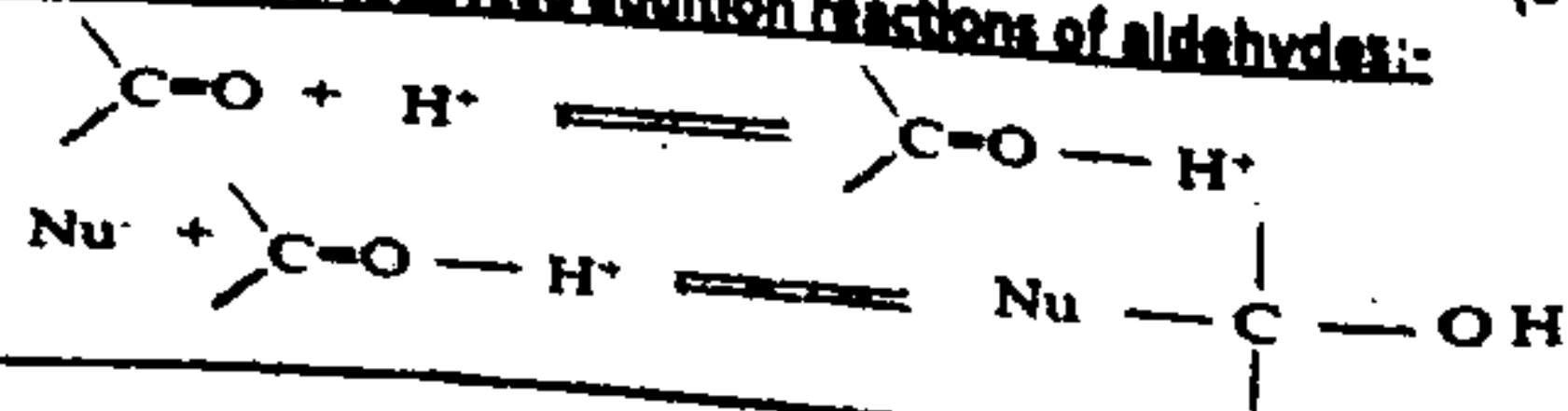
$(CH_3)_2C{=}O + NaHSO_3 \longrightarrow (CH_3)_2C(OH)(SO_3Na)$

Acetone — Bisulphite addition sulphate

Topic No: 12.5.1/B

30 Give general mechanism of acid catalyzed addition reactions of aldehydes? (3 times)

Ans: **Mechanism of acid catalyzed addition reactions of aldehydes:-**

$$>C{=}O + H^+ \rightleftharpoons \;>C{=}O - H^+$$

$$Nu^- + \;>C{=}O - H^+ \rightleftharpoons Nu - \overset{|}{\underset{|}{C}} - OH$$

31 How ethanal react with Phenyl Hydrazine? Give reaction.

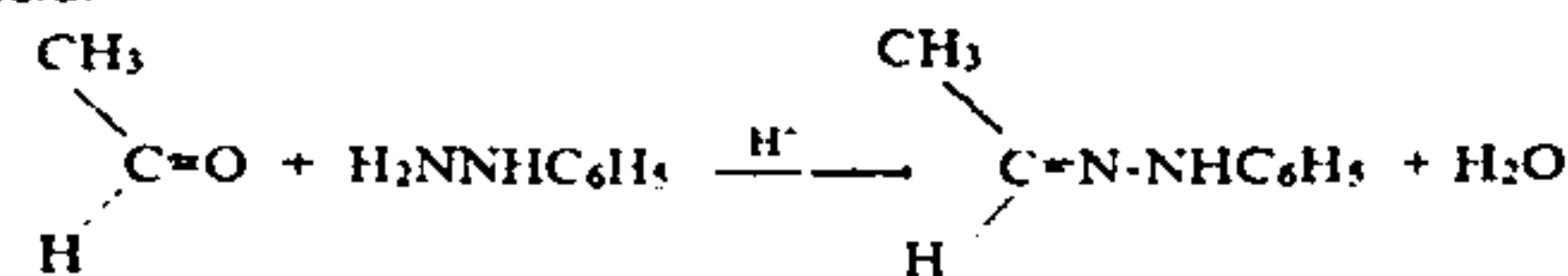
Ans: **Reaction of Ethanal with Phenyl Hydrazine:-**

$(CH_3)(H)C{=}O + H_2NNHC_6H_5 \xrightarrow{H^+} (CH_3)(H)C{=}N\text{-}NHC_6H_5 + H_2O$

Ethanal — Ethanal phenylhydrazone

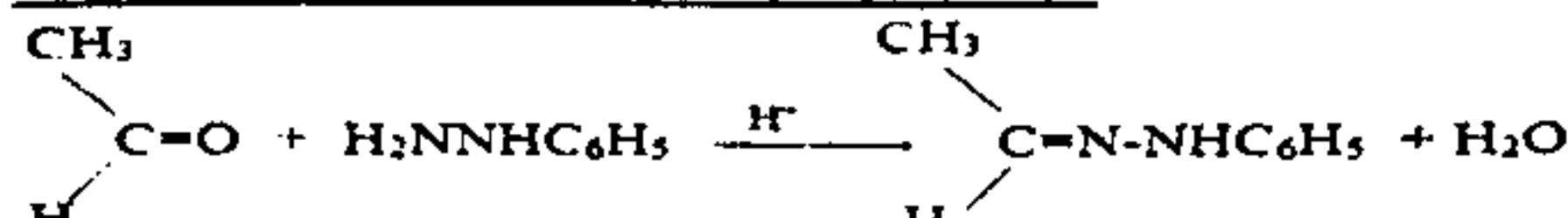
32 How aldehyde reacts with hydrdzine? Give its mechanism

Ans: Aldehyde react with phenyl hydrazine to form phenylhydrazone in the presence of an acid.

$(CH_3)(H)C{=}O + H_2NNHC_6H_5 \xrightarrow{H^+} (CH_3)(H)C{=}N\text{-}NHC_6H_5 + H_2O$

Ethanal — Ethanal phenylhydrazone

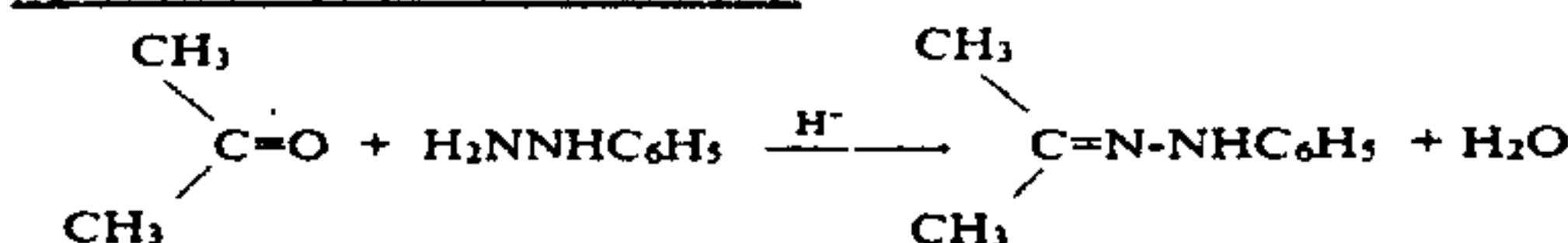
33. Write the reaction of phenyl hydrazine with acetaldehyde?

Ans: **Reaction of Ethanal with Phenyl Hydrazine:-**

$(CH_3)(H)C{=}O + H_2NNHC_6H_5 \xrightarrow{H^+} (CH_3)(H)C{=}N\text{-}NHC_6H_5 + H_2O$

Ethanal — Ethanal phenylhydrazone

34. How hydrazine reacts with acetone?

Ans: **Reaction of hydrazine with acetone:**

$(CH_3)_2C{=}O + H_2NNHC_6H_5 \xrightarrow{H^+} (CH_3)_2C{=}N\text{-}NHC_6H_5 + H_2O$

Propanone — Propanone phenylhydrazone

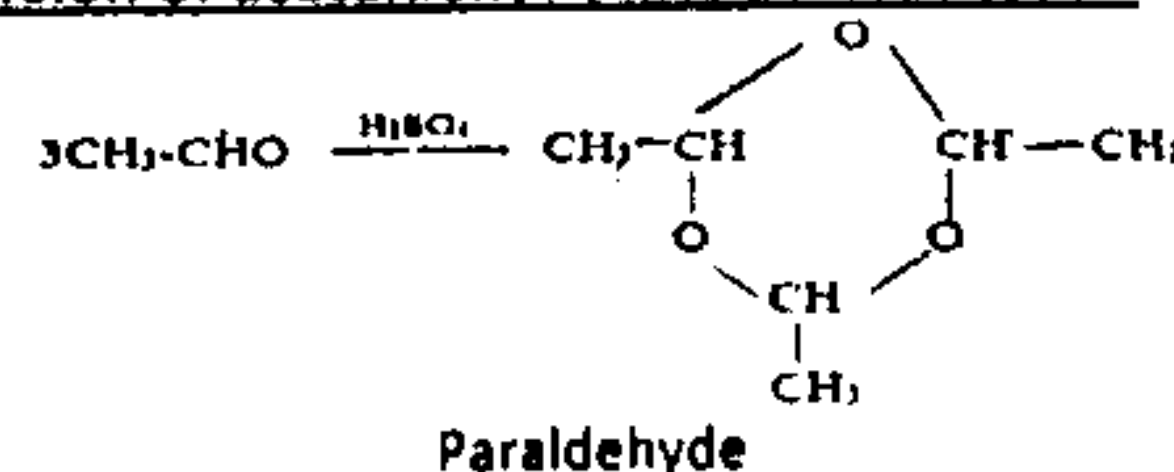
35 Write the reaction of iodoform formation by using acetone?

Ans: **Iodoform formation by using acetone:-**

$CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}CH_3 + 3I_2 + 4\,NaOH \rightleftharpoons CH_3I + CH_3COONa + 3NaI + 3H_2O$

36 Convert acetaldehyde into paraldehyde by a reaction which is done in presence of dilute H_2SO_4? (3 times)

Ans: **Conversion of acetaldehyde into paraldehyde:-**

$3CH_3\text{-}CHO \xrightarrow{H_2SO_4}$ (cyclic trimer: $CH_3\text{-}CH$, $CH\text{-}CH_3$, $CH(CH_3)$ joined through three O atoms)

Paraldehyde

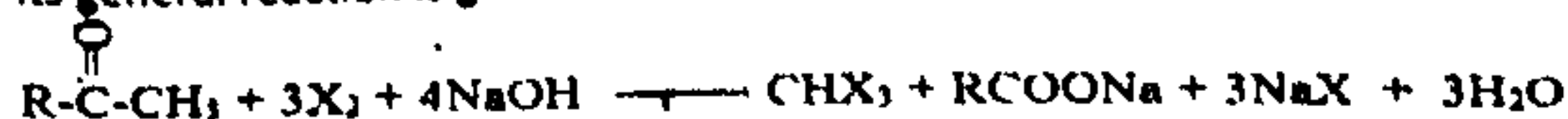
37 Justify that Cannizzaro's reaction is self oxidation-reduction reaction? (4 times)

Ans: Cannizzaro's reaction is a disproportionation (self oxidation and reduction) reaction. Two molecules of the aldehyde are involved, one molecule being converted into the corresponding alcohol (the reduced product) and the other into the acid in the salt form (the oxidation product).

38 What is haloform reaction? (4 times)

Ans: **Haloform reaction:-** Acetaldehyde and methyl ketones react with halogens in the presence of sodium hydroxide to give haloform, this reaction is called haloform reactions. The tem haloform is used for the reaction because a haloform (chloroform, bromoform or iodoform) is one of the product.

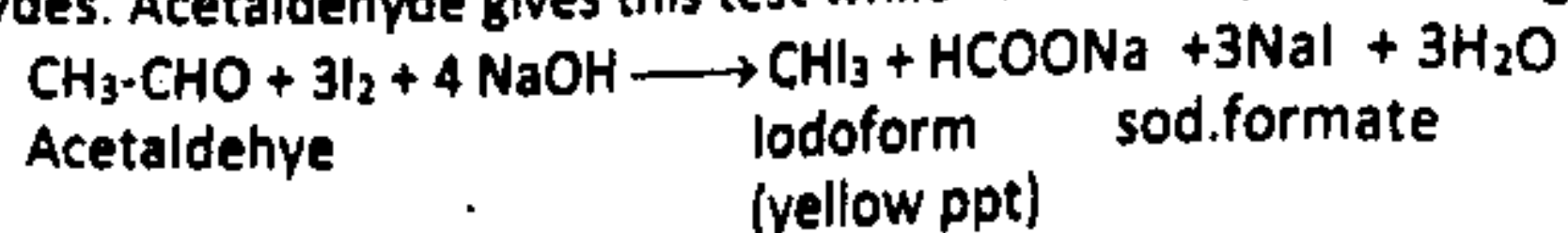
Its general reaction is give below:

$R\text{-}\overset{O}{\overset{\|}{C}}\text{-}CH_3 + 3X_2 + 4NaOH \longrightarrow CHX_3 + RCOONa + 3NaX + 3H_2O$

39 What is the use of iodoform test to distinguish between acetaldehyde and formaldehyde? (3 times)

Ans: The haloform reaction using iodine and aqueous sodium hydroxide is called the iodoform test. It results in the formation of water insoluble iodofrom which is yallow solid. Iodoform test is used for distinguish acetaldehyde from other aldehydes. Acetaldehyde gives this test while formaldehyde do not give this test.

$$CH_3\text{-}CHO + 3I_2 + 4\,NaOH \longrightarrow CHI_3 + HCOONa + 3NaI + 3H_2O$$

Acetaldehye — Iodoform (yellow ppt) — sod.formate

$$HCHO + 3I_2 + 4\,NaOH \longrightarrow \text{No reaction}$$

40 Iodoform test can be used to distinguished between methyl alcohol and ethyl alcohol. Justify it?

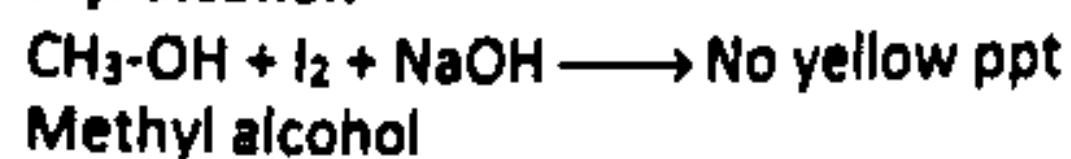
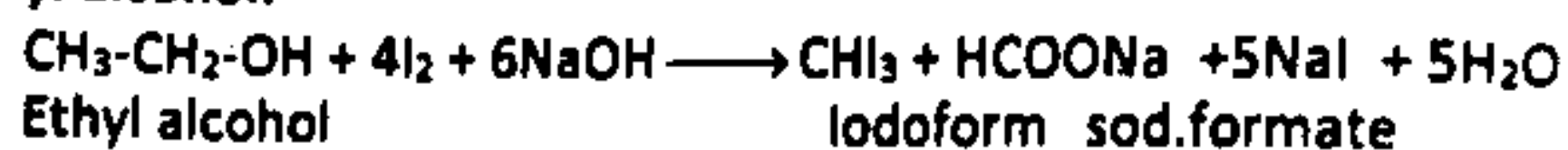
Ans: **For methyl alcohol:**

$$CH_3\text{-}OH + I_2 + NaOH \longrightarrow \text{No yellow ppt}$$

Methyl alcohol

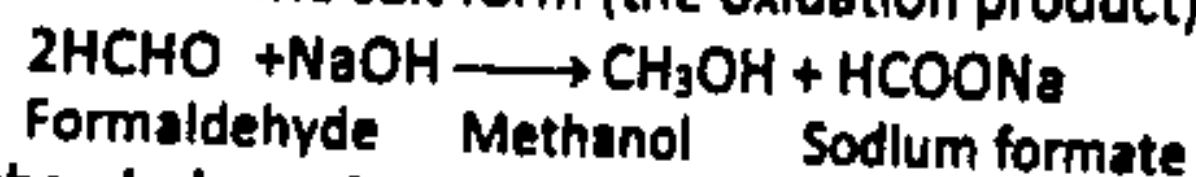
For ethyl alcohol:

$$CH_3\text{-}CH_2\text{-}OH + 4I_2 + 6NaOH \longrightarrow CHI_3 + HCOONa + 5NaI + 5H_2O$$

Ethyl alcohol — Iodoform — sod.formate

41 What is Cannizzaro,s reaction? Write one example. (3 times)

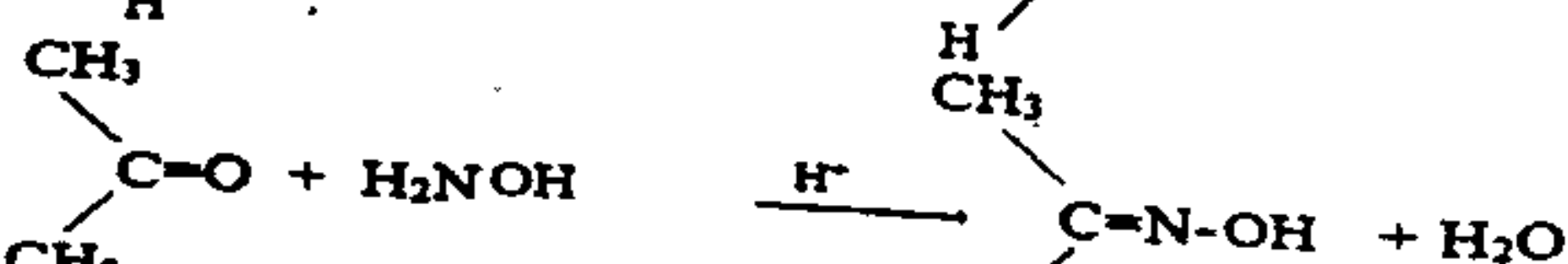
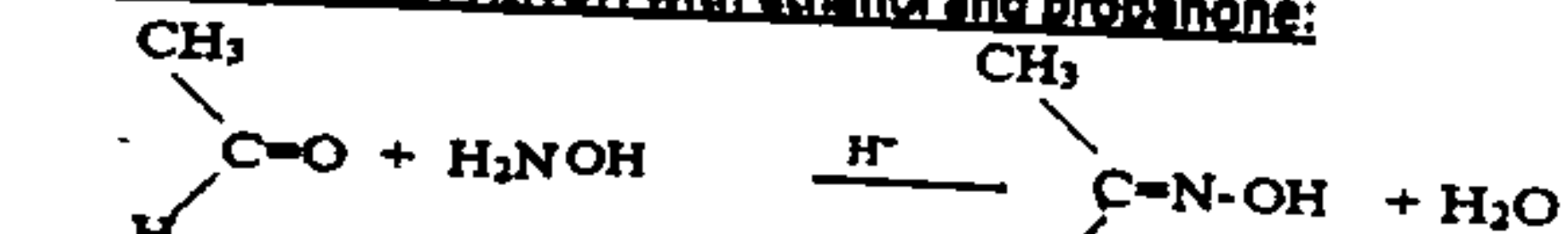
Ans: Aldehydes that have no α-hydrogen atoms undergo cannizzaro's reaction. Cannizzaro's reaction is a disproportionation (self oxidation and reduction reaction. Two molecules of the aldehyde are involved, one molecule being converted into the corresponding alcohol (the reduced product) and the other into the acid in the salt form (the oxidation product).

$$2HCHO + NaOH \longrightarrow CH_3OH + HCOONa$$

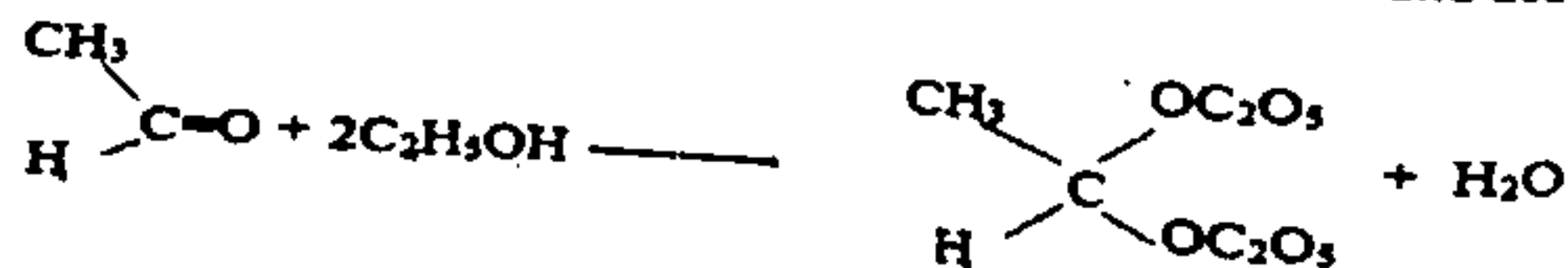
Formaldehyde — Methanol — Sodium formate

42. Write chemical reaction of H_2NOH with ethanol & propanone in presence of acid

Ans: **Chemical reaction of H_2NOH with ethanol and propanone:**

$$(CH_3)(H)C{=}O + H_2NOH \xrightarrow{H^+} (CH_3)(H)C{=}N\text{-}OH + H_2O$$

$$(CH_3)_2C{=}O + H_2NOH \xrightarrow{H^+} (CH_3)_2C{=}N\text{-}OH + H_2O$$

43. Give reaction of aldehyde with alcohol to produce hemi acetal and acetal.

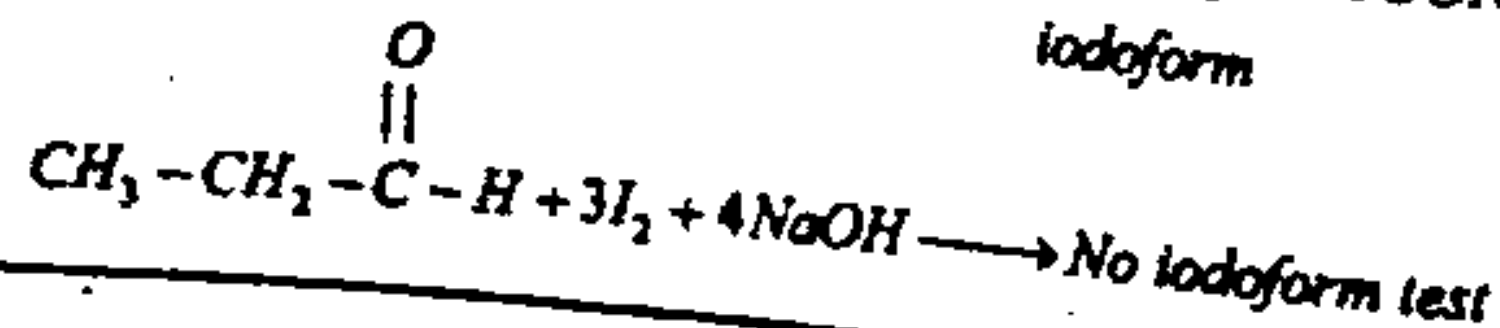
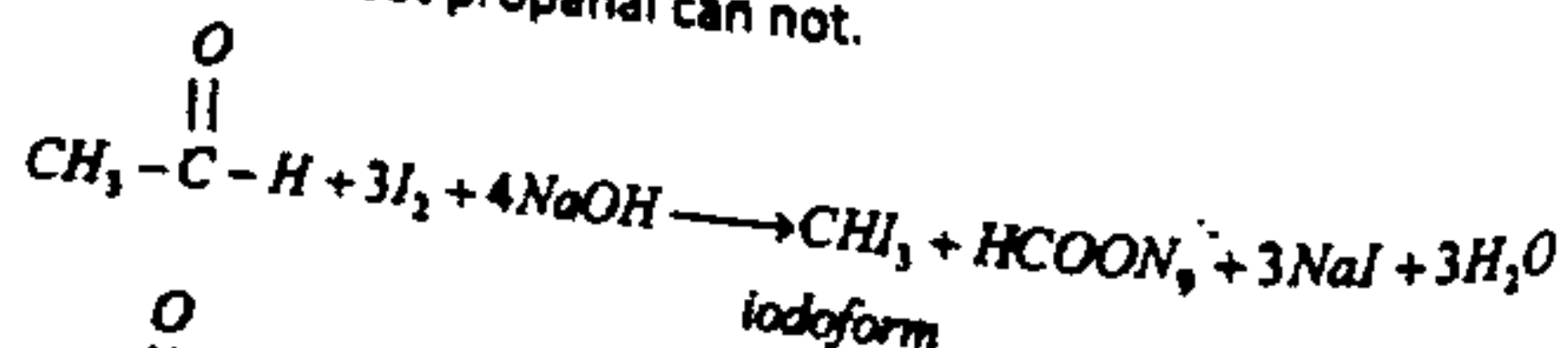
Ans:

$$(CH_3)(H)C{=}O + 2C_2H_5OH \longrightarrow (CH_3)(H)C(OC_2O_5)_2 + H_2O$$

1,1-Diethoxyethane (an acetal)

44. Distinguish between ethanol and propanol.

Ans: Ethanol gives iodoform test but propanal can not.

$$CH_3-\overset{O}{\overset{\|}{C}}-H + 3I_2 + 4NaOH \longrightarrow \underset{iodoform}{CHI_3} + HCOON_a + 3NaI + 3H_2O$$

$$CH_3-CH_2-\overset{O}{\overset{\|}{C}}-H + 3I_2 + 4NaOH \longrightarrow \text{No iodoform test}$$

45. Distinguish Chemically between "Acetone" and "Ethyl alcohol".

Ans: We use sodium nitroprusside test for this purpose.
Acetone would produce a wine red colour with alkaline sodium nitroprusside solution while no such colour is produced with Ethyl alcohol.

Topic No: 12.5.2

46 Which products are formed by the catalytic reduction of aldehydes? Gives one example.

Ans: Aldehyde and ketones on reduction with hydrogen in the presence of a metal catalyst like Pd, Pt or Ni from primary and secondary alcohols respectively. Hydrogen is added across the carbonyl group.

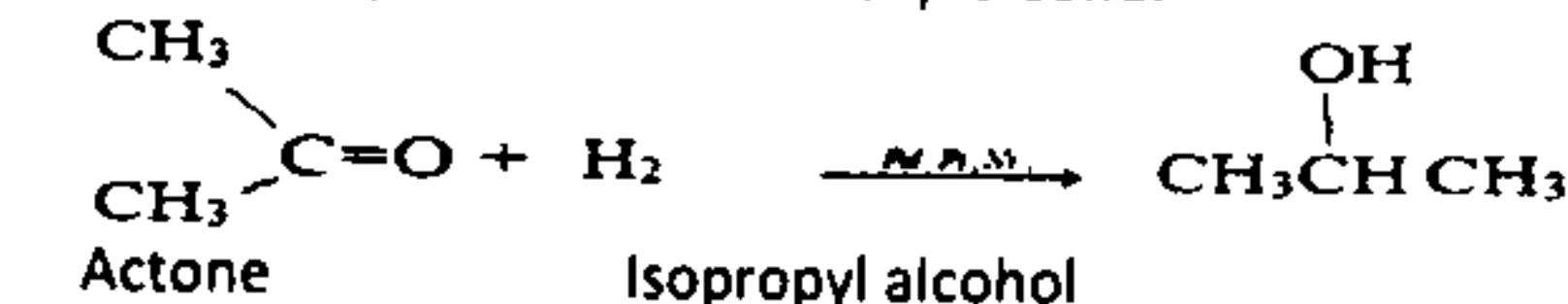
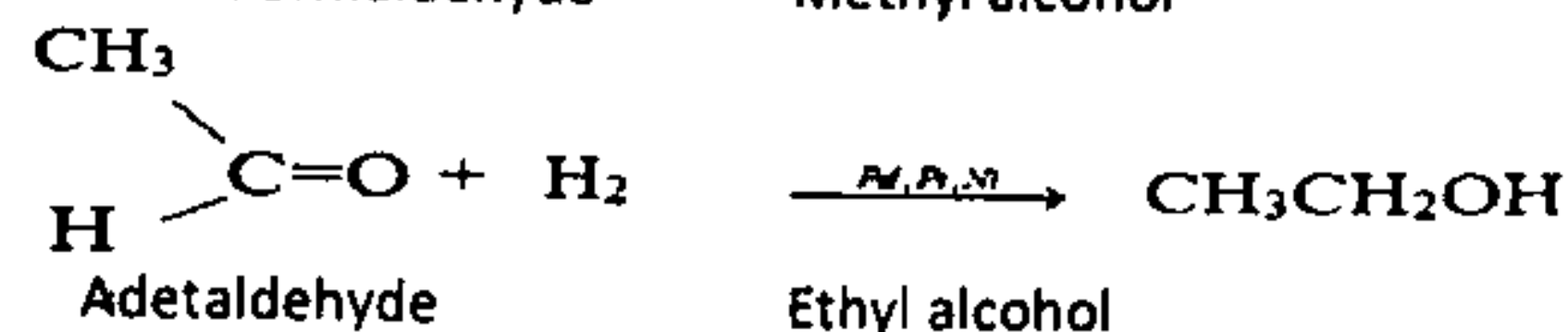
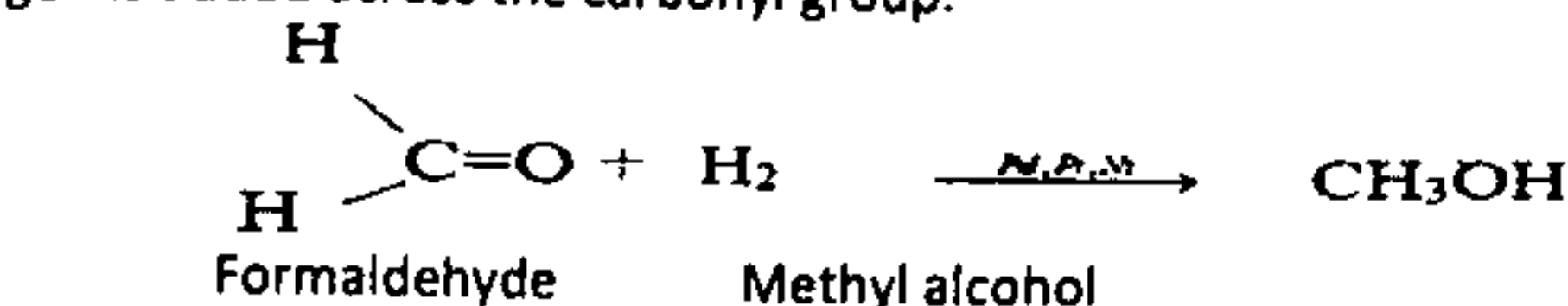
$$(H)(H)C{=}O + H_2 \xrightarrow{Ni,Pt,Ni} CH_3OH$$

Formaldehyde — Methyl alcohol

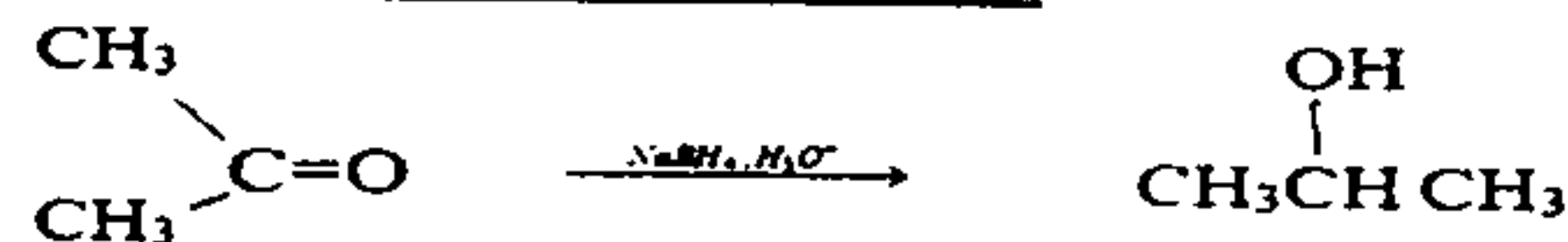
$$(CH_3)(H)C{=}O + H_2 \xrightarrow{Ni,Pt,Ni} CH_3CH_2OH$$

Adetaldehyde — Ethyl alcohol

$$(CH_3)_2C{=}O + H_2 \xrightarrow{Ni,Pt,Ni} CH_3\overset{OH}{\overset{|}{C}H}CH_3$$

Actone — Isopropyl alcohol

47. Convert acetone into 2-propanol alcohol? (2 times)

Ans: **Conversion of acetone into 2-propanol alcohol:**

$$(CH_3)_2C{=}O \xrightarrow{NaBH_4,\,H_2O} CH_3\overset{OH}{\overset{|}{C}H}CH_3$$

Topic No: 12.5.3

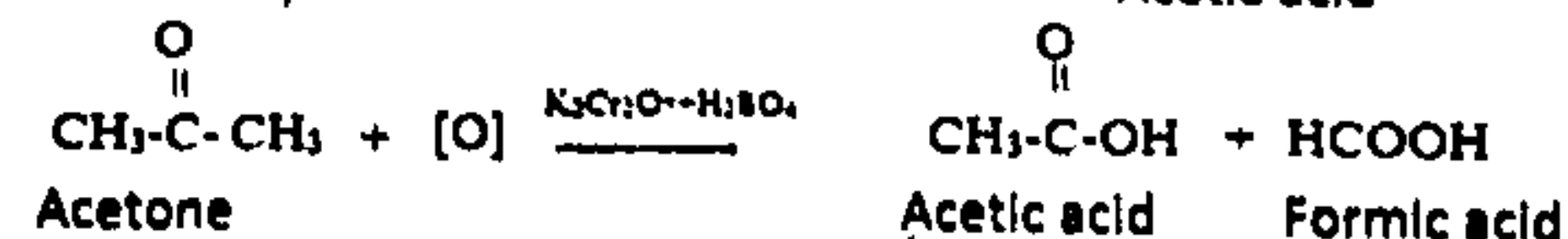
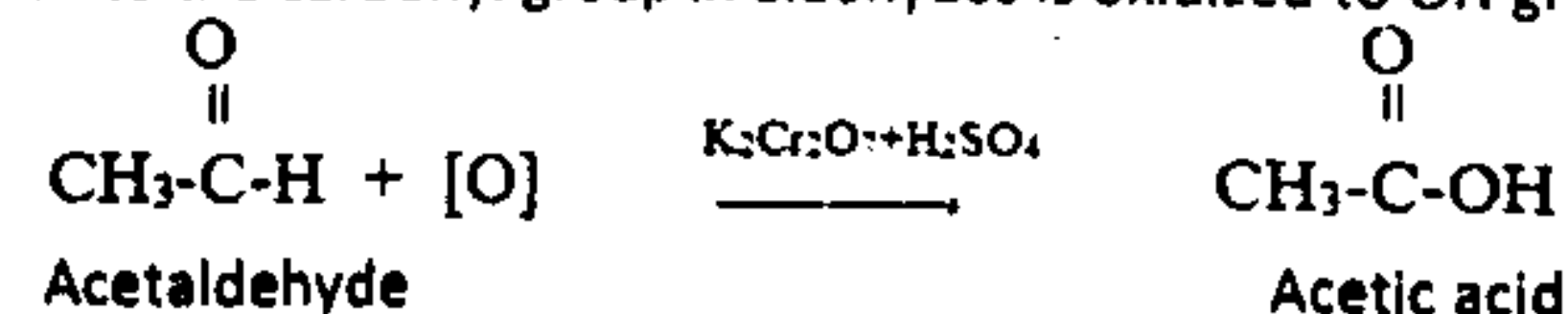
48 How α-hydroxy acids are produced from aldehyde and ketones? (3 times)

Ans: α-hydroxy acids are produced from aldehyde and ketones by oxidation process using strong oxidizing agents as $K_2Cr_2O_7/H_2SO_4$, $KMnO_4/H_2SO_4$. The oxygen atom attached to the carbonyl group in aldehydes is oxidized to OH group.

$$CH_3-\overset{O}{\overset{\|}{C}}-H + [O] \xrightarrow{K_2Cr_2O_7+H_2SO_4} CH_3-\overset{O}{\overset{\|}{C}}-OH$$

Acetaldehyde — Acetic acid

$$CH_3-\overset{O}{\overset{\|}{C}}-CH_3 + [O] \xrightarrow{K_2Cr_2O_7+H_2SO_4} CH_3-\overset{O}{\overset{\|}{C}}-OH + HCOOH$$

Acetone — Acetic acid — Formic acid

Topic No: 12.6/1

49 Distinguish between ethanol and propanone by a chemical test?(2 times)

Ans: **Ethanol and propanone:-** Propanone is a ketone, it forms red precipitates with 2,4-DNPH (Dinitrophenyl hydrazine) solution while ethanol does not give this test. Porpanone will produce orange-red colour on adding alkaline sodium nitroprusside solution while ethanol does not give this test also.

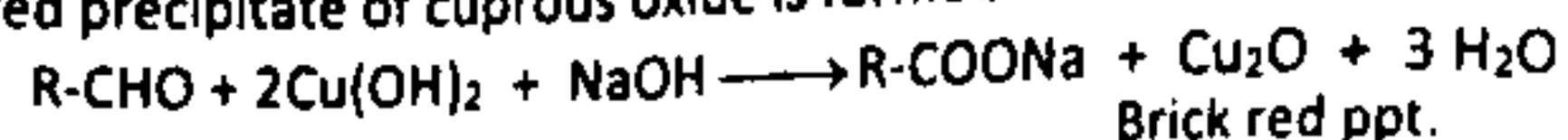
Topic No: 12.6/2

50 What is sodium bisulphate test ?

Ans: **Sodium bisulphate test:-** Aldehydes and small methyl ketones form a crystalline white precipitate with saturated sodium bisulphite solution.

51. **What is Benedict's solution test? Also give its reaction with acetaldehyde?**

Ans: **Benedict's solution test:**Aliphatic aldehydes form a brick red precipitate with Benedicts's solution . to an aldehyde solution, add Benedict's solution and boil, brick red precipitate of cuprous oxide is formed.

$$R\text{-}CHO + 2Cu(OH)_2 + NaOH \longrightarrow R\text{-}COONa + \underset{\text{Brick red ppt.}}{Cu_2O} + 3H_2O$$

Topic No: 12.6/3

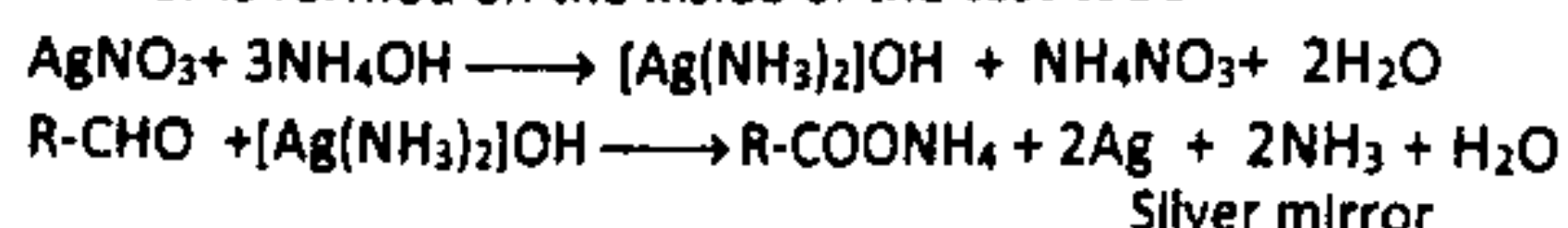
52 **Write the names of those weak oxidizing agents which can oxidize aldehyde but not the ketone?**

Ans: Tollen's reagent, Fehling' solution and Bendict's solution.

53 **Give chemical changes in two steps that occur by the addition of Tollen's Reagent to an aldehyde in a test tube and heated?**

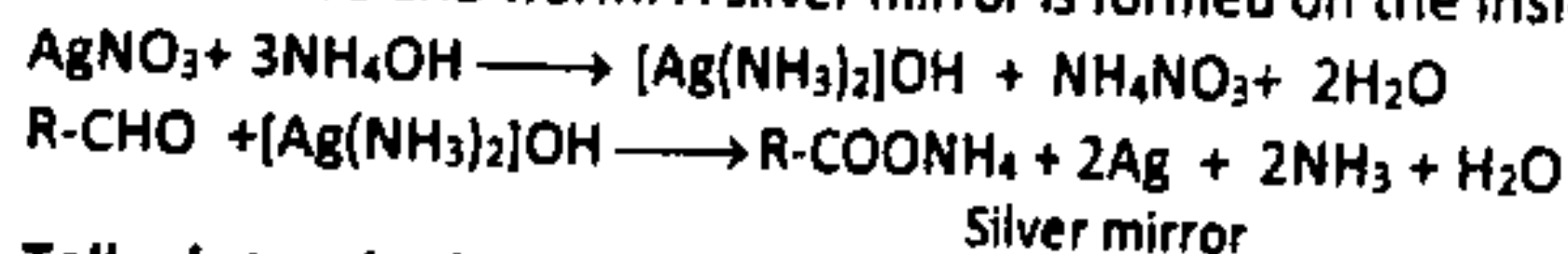
Ans: Aldehyde form silver mirror with Tollen's reagent (ammonical silver nitrate solution). Add Tolllen's reagent to an aldehyde solution in a test tube and warm A silver mirror is formed on the inside of the test tube.

$$AgNO_3 + 3NH_4OH \longrightarrow [Ag(NH_3)_2]OH + NH_4NO_3 + 2H_2O$$

$$R\text{-}CHO + [Ag(NH_3)_2]OH \longrightarrow R\text{-}COONH_4 + \underset{\text{Silver mirror}}{2Ag} + 2NH_3 + H_2O$$

54 **What is silver mirror test ? What is its importance?** **(5 times)**

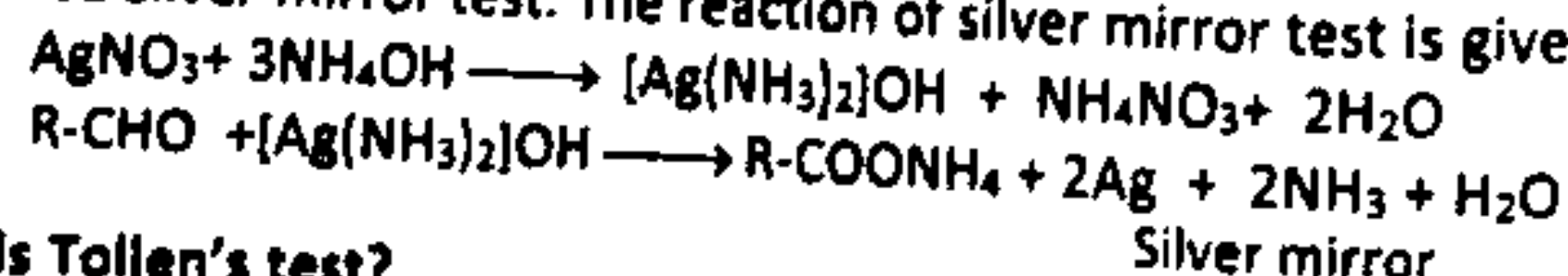
Ans: **Silver mirror test:-** Aldehyde form silver mirror with Tollen's reagent (ammonical silver nitrate solution). Add Tolllen's reagent to an aldehyde solution in a test tube and warm. A silver mirror is formed on the inside of the test tube.

$$AgNO_3 + 3NH_4OH \longrightarrow [Ag(NH_3)_2]OH + NH_4NO_3 + 2H_2O$$

$$R\text{-}CHO + [Ag(NH_3)_2]OH \longrightarrow R\text{-}COONH_4 + \underset{\text{Silver mirror}}{2Ag} + 2NH_3 + H_2O$$

55 **Tollen's test is also called Silver mirror test . Justify it.** **(2 times)**

Ans: Aldehyde form silver mirror with Tollen's reagent (ammonical silver nitrate solution). Add Tolllen's reagent to an aldehyde solution in a test tube and warm A silver mirror is formed on the inside of the test tube. Therefore, Tollen's test also called silver mirror test. The reaction of silver mirror test is given below as:

$$AgNO_3 + 3NH_4OH \longrightarrow [Ag(NH_3)_2]OH + NH_4NO_3 + 2H_2O$$

$$R\text{-}CHO + [Ag(NH_3)_2]OH \longrightarrow R\text{-}COONH_4 + \underset{\text{Silver mirror}}{2Ag} + 2NH_3 + H_2O$$

56. **What is Tollen's test?** **(2 times)**

Ans: **Tollen's test:**Aldehyde form silver mirror with Tollen's reagent (ammonical silver nitrate solution). Add Tolllen's reagent to an aldehyde solution in a test tube and warm. A silver mirror is formed on the inside of the test tube.

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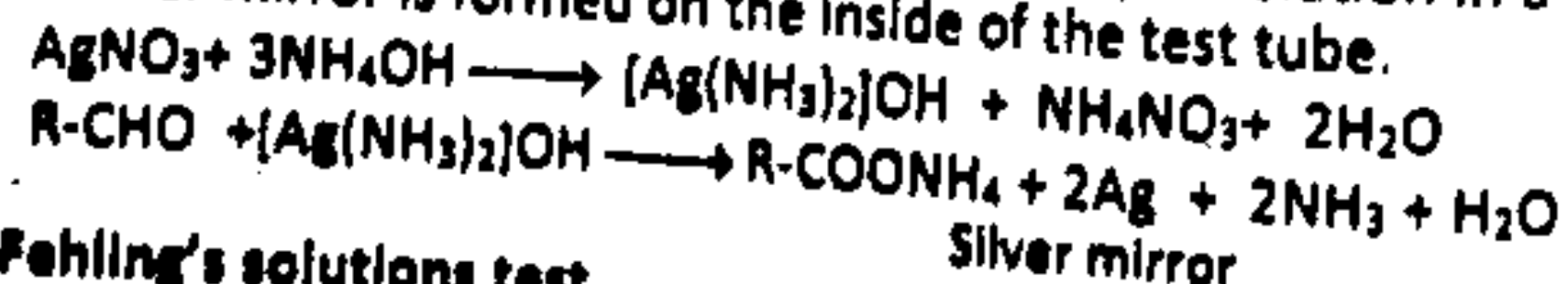

57. **Write Fehling's solutions test.**

Ans: Aliphatic aldehydes give brick red precipitate when boiled with Fehling solution.

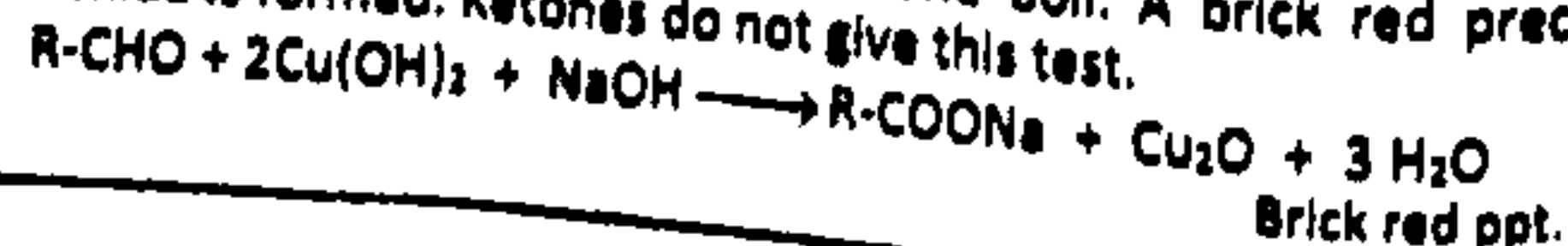
$$R-CHO + 2Cu(OH)_2 + NaOH \longrightarrow RCOONa + Cu_2O + 3H_2O$$

Ketones do not give this test

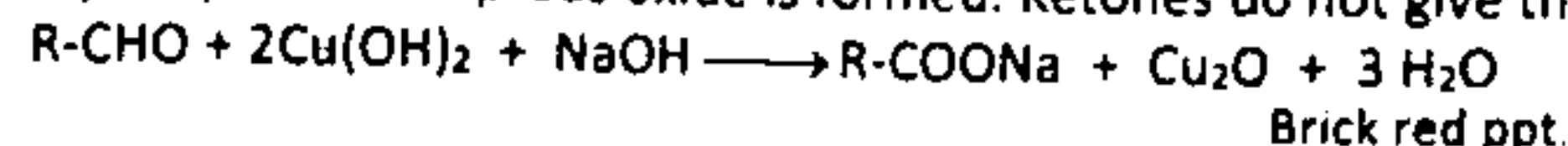
Topic No: 12.6/4

58 **Fehling's solution reacts with aldehydes to give red ppt. Justify it.(3 times)**

Ans: Aliphatic aldehydes form a brick-red precipitate with Fehling's solution. To an aldehyde solution, add Fehling's solution and boil. A brick red precipitate of cuprous oxide is formed. Ketones do not give this test.

$$R\text{-}CHO + 2Cu(OH)_2 + NaOH \longrightarrow R\text{-}COONa + \underset{\text{Brick red ppt.}}{Cu_2O} + 3H_2O$$

59 **Write Fehling's solution test?** **(9 times)**

Ans: **Fehling's solution test:-**Aliphatic aldehydes form a brick-red precipitate with Fehling's solution. To an aldehyde solution, add Fehling's solution and boil. A brick red precipitate of cuprous oxide is formed. Ketones do not give this test.

$$R\text{-}CHO + 2Cu(OH)_2 + NaOH \longrightarrow R\text{-}COONa + \underset{\text{Brick red ppt.}}{Cu_2O} + 3H_2O$$

Topic No: 12.6.6

60 **What is sodium nitroprusside test?** **(3 times)**

Ans: Ketones produce a wine red or orange red colour on adding alkaline sodium nitroprusside solution dropwise. Aldehyde don't give this test.

Topic No: 12.7

61 **Write down four uses of acetaldehyde?** **(6 times)**

Ans:
(i).. It is used to make acetaldehyde ammonia used as a rubber –accelerator.
(ii).. It is used as an antiseptic inhalant in nasal infections.
(iii).. It isused in silvering of mirrors.
(iv).. It is used to make phenolic resins and synthetic drugs.

62 **What is Formalin?** **(2 times)**

Ans: **Formalin:-**Methyl alcohol is oxidized to gaseous formaldehyde which is absorbed in water. The resulting mixture is called formalin. Formalin is a mixture of 40% formaldehyde , 8% methyl alcohol and 52% water.

63 **Give any two uses of formaldehyde and any two uses of acetaldehyde?**

Ans: **Uses of formaldehyde**(i).. It is used as decolouring agent in vat dyeing.
(ii).. It is used in the silvering of mirrors.
(iii).. It is used in making medicine urotropine used as a urinary antiseptic.
(iv).. It is used in the processing of anti-poliovaccine.

Uses of acetaldehyde
(i).. It is used to make acetaldehyde ammonia used as a rubber –accelerator.
(ii).. It is used as an antiseptic inhalant in nasal infections.
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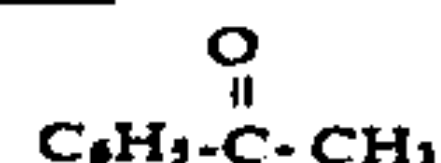
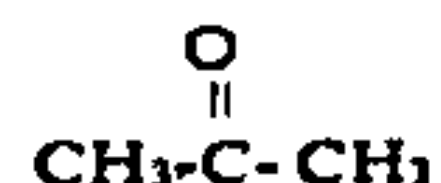
(ii).. It is used in the silvering of mirrors.
(iii).. It is used in making medicine urotropine used as a urinary antiseptic.
(iv).. It is used in the processing of anti-poliovaccine.

65 **Write down the formulas of the following :(i)Acetophenone** **(ii) Acetone**

Ans: **(i)Acetophenone:**

$$C_6H_5\text{-}\overset{\overset{\displaystyle O}{\|}}{C}\text{-}CH_3$$

(ii) Acetone:

$$CH_3\text{-}\overset{\overset{\displaystyle O}{\|}}{C}\text{-}CH_3$$

66. **Give formulas of formaldehyde and acetaldehyde.**

Ans: Formulaof formaldehyde : $HCHO$
Formulas of acetaldehyde : CH_3CHO

67 **How will you distinguish between acetaldehyde and benzaldehyde?**

Ans: Acetaldehyde is an aldehyde having α-hydrogen atom which react with a cold dilute solution of an alkali to form product known as aldol. While benzaldehyde is an aldehyde having no α- hydrogen atom so under which react with a cold dilute solution of an alkali to form product known as Cannizzaro's product.

68 **Write chemical formulas of hydroxylamine and phenyl hydrazine.**

Ans: Chemical formulas of hydroxylamine: NH_2OH
Chemical formulas of phenyl hydrazine: $C_6H_5NHNH_2$

LONG QUESTIONS OF CHAPTER- 12
ALDEHYDE AND KETONES
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 12.3

1. Prepare Acetaldehyde from: (i) Calcium Acetate ii) Ethyl Alcohol
Ans: (Text Book Page No:231)
2. Write laboratory and industrial preparation for Acetaldehyde. (2 times)
Ans: (Text Book Page No:231)
3. Describe the laboratory method of preparation of formaldehyde with diagram. (2 times)
Ans: (Text Book Page No:230)

Topic No: 12.5.1

4. How does formaldehyde reacts with the following réagents?
i)HCN ii) $NaHSO_3$ iii) $NaBH_4 / H_2O$ iv) Conc. NaOH
Ans: (Text Book Page No:242)
5. Discuss reactions of ethanol & propanone with: i) Hydroxylamine ii) Phenyl hydrazine
Ans: (Text Book Page No:240)
6. Write the reactions of ethanal with: (i) HCN (ii) $NAHSO_3$ (iii) H_2NOH (iv) H_2NNH_2
Ans: (Text Book Page No:233)
7. Explain mechanism of addition of sodium bisulphate to acetone? What is the utility of this reaction.

Topic No: 12.5.1/b-2

8. Write the reaction mechanism of an aldehyde with an ammonia derivative.
Ans: (Text Book Page No:240)
9. Give reactions of acetone & acetaldehyde with:i) Hydroxyl amino ii) Hydrazine
Ans: (Text Book Page No:240)
10. Explain the mechanism of reaction of phenylhydrazine with Acetone.(2 times)
Ans: (Text Book Page No:240)

Topic No: 12.5.1/4

11. Define aldol condensation. Give its mechanism. (7 times)
Ans: (Text Book Page No:235)

Topic No: 12.5.1/5

12. Define Cannizaro's reaction. Explain its mechanism with a suitable example. (8 times)
Ans: (Text Book Page No:237)

Topic No: 12.5.2

13. Discuss reduction of carbonyl compounds with sodium borohydribde with proper mechanism.
Ans: (Text Book Page No:242)

Topic No: 12.5.3

14. Why oxidation of ketones does not occur easily? What strong oxidizing agent is used to oxidize ketones.
Ans: (Text Book Page No:244)

Topic No: 12.6

15. Discuss Haloform reactions with one example. (2 times)
Ans: (Text Book Page No:238)
16. Write the chemical equation involved in Tollen's and Fehling's solution tests. Give colour of precipitates formed in each case. Why
Ans: (Text Book Page No:244)

17. Tollen's test is also known as silver mirror test.
Ans: (Text Book Page No:244)
18. Describe various tests for identification of carbonyl compounds.
Ans: (Text Book Page No:241)
19. Discuss oxidation of aldehyde with : (i) $K_2Cr_2O_7 / H_2SO_4$ (ii) Tollen's reagent.
Ans: (Text Book Page No:243)
20. Write four tests by which aldehydes can be distinguished from ketones. (2 times)
Ans: (Text Book Page No:239)

Topic No: 12.7

21. Write any four uses of acetaldehyde. (2 times)
Ans: (Text Book Page No:245)
22. Convert the following:i) Propyne into acetone ii) Ethyne into oxalic acid
23. Distinguish between (i) Butanone & 3-pentanone (ii)Acetaldehyde & benzaldehyde
24. Prepare Acetaldehyde cyanohydrine from acetaldehyde and then convert in into 2-hydroxypropanoic acid.
Ans: (Text Book Page No:233)
25. Write equations for the reactions of Acetaldehyde with.
(i) HCN (ii) $CH_3 - CH_2 - MgBr$ (iii) $I_2/NaOH$ (iv) $NH_2 - NH - C_6H_5$
Ans: (Text Book Page No:238)
26. How does acetaldehyde react with following reagents.
(i) C_2H_5MgI (ii) HCN (iii) $NaHSO_3$ (iv) $I_2 / NaOH$
Ans: (Text Book Page No:234)
27. By using propanone as a starting material, how would you get?
i) acetic acid ii) isoprophl alcohol
Ans: (Text Book Page No:244)
28. Write a note on oxidation of aldehydes and ketones.
Ans: (Text Book Page No:243)

OBJECTIVES (MCQ'S) OF CHAPTER- 13
CARBOXYLIC AICDS
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 13.1

1. Which of the following is not a fatty acid? (7 times)
(a) Propionic acid (b) Acetic acid (c) Phthalic acid (d) Butanoic acid
2. Which of the following is not a fatty acid? (2 times)
(a) Carboxylic acid (b) Glutamic acid (c) Aspartic acid (d) Phthalic acid

Topic No: 13.3

3. Acetic acid is manufactured by: (7 times)
(a) Distillation (b) Fermentation (c) Ozonalysis (d) Esterification
4. Ethanol can be converted into ethanoic acid by:
(a) Hydrogenation (b) Hydration (c) Oxidation (d) Fermentation
5. An Aqueous Solution of an organic compound reacts with Na_2CO_3 to produce CO_2 Gas. Which one of the following could be the Organic Compound? (2 times)
(A) $CH_2 = CH-CH_3$ (B) CH_3 - CHO (C) $CH_3COOC_2H_5$ (D) $CH_3—CH_2$--COOH

Topic No: 13.4

6. Acyclic dimer of acetic acid is formed when it is added to benzene .The number of oxygen atoms in a dimer ring is/are:
(a)One (b) two (c)four (d)six
7. Which one has the higher boiling point?
(a) HCOOH (b) CH_3COOH (c) C_2H_5COOH (d)CH_3-CH_2- CH_2COOH

8. **Among the Aliphatic Carboxylic Acids first four members are Soluble in water due to:**

(A) London Dispersion Forces (B) Hydrogen Bonding
(C) Ion – Dipole Forces (D) Covalent Bond

Topic No: 13.5

9- **One of the following organic compound react with Sodium Bicrbonate to produce CO_2 gas:**

(a) CH_3COOH (b) $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$ (c) CH_3-CH_2-OH (d) CH_3COCH_3

Topic No: 13.6

10. **Which of the following reagent is used to reduce carboxylic group to alcohol? (9 times)**

(a) N_2/Ni (b) H_2/Pt (c) $NaBH_4$ (d) $LiAlH_4$

11. **The reagent used to convert carboxylic directly to alkane is: (3 times)**

(a) HI/P (b) $NaBH_4$ (c) $LiAlH_4$ (d) H_2/Ni

12. **Which derivative cannot be prepared directly from acetic acid? (4 times)**

(a) Acetamide (b) Acetyl chloride (c) Acetic anhydride (d) Ethyl acetate

13. **The flavour of Benzyl acetate is: (2 times)**

(a) Orange (b) Apricot (c) Banana (d) Jasmine

14- **Acetamide is prepared by: (2 times)**

(A) heating ammonium acetate (B) heating methyl cyanide
(C) heating ethyl acetate (D) the hydrolysis of methyl cyanide

15- **Which of the following esters has orange flavour:**

(A) Amyl acetate (B) Benzyl acetate (C) Amyl butyrate (D) Octyl acetate

Topic No: 13.7

16. **The compound used in the manufacture of synthetic fiber is: (3 times)**

(a) Formic acid (b) Acetic acid (c) Oxalic acid (d) Carbonic acid

17. **The solution of the acid used for seasoning of food is: (8 times)**

(a) Formic acid (b) Acetic acid (c) Benzonic acid (d) Butanonic acid

18. **The flavour of amyl acetate is:**

(a) Orange (b) Apricot (c) Banana (d) Pine apple

Topic No: 13.7.3

19. **Molar mass of CH_3COOH obtained by elevation of boiling point method is:**

(a) 30 (b) 60 (c) 120 (d) 180

ANSWERS TO MULTIPLE CHOICE QUESTIONS:

1	2	3	4	5	6	7	8	9	10	11	12	13
C	D	B	C	D	C	D	B	A	D	A	A	D
14	15	16	17	18	19							
A	D	B	B	C	B							

SHORT QUESTIONS OF CHAPTER- 13
CARBOXYLIC AICDS
ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 13.1

1 **What are Aliphatic and aromatic carboxylic acids? Give one example?**

Ans: **Aliphatic and aromatic carboxylic acids:-**

The carboxylic acid, in which $-\overset{O}{\overset{\|}{C}}-OH$ is attached to alkyl group (or a hydrogen atom) is called aliphatic carboxylic acid.

$R-\overset{O}{\overset{\|}{C}}-OH$ where R is alkyl group or a hydrogen atom

The carboxylic acid, in which $-\overset{O}{\overset{\|}{C}}-OH$ is attached to aryl group is called aromatic carboxylic acid

$Ar-\overset{O}{\overset{\|}{C}}-OH$ where R is phenyl or aryl group

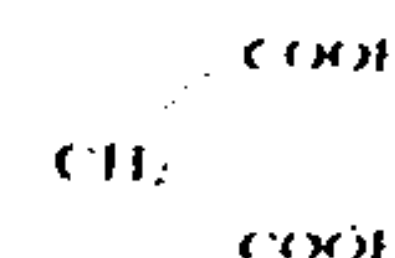
2 **What are carbocyclic compounds?**

Ans: **Carbocyclic compounds:-** Organic compounds containing (–COOH) as a functional group are called carboxylic compounds. The (–COOH) group which itself is made up of a carbonyl group (> C=O) and a hydroxyl group (–OH).

3 **Write down structural formulae of pthalic acid and malonic acid? (3 times)**

Ans: **Structural formulae of pthalic acid and malonic acid:-**

Phthalic acid

$CH_2(COOH)_2$ — COOH / CH_2 / COOH

Malonic acid

Topic No: 13.2

4 **Write down formula for : (a) palmitic acid (b) strearic acid**

Ans: (a).. Formula of palmitic acid is: $C_{15}H_{31}COOH$

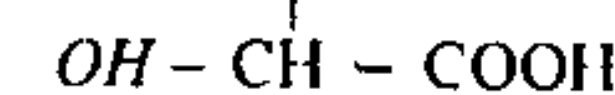
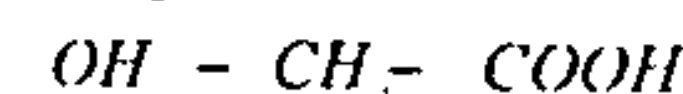
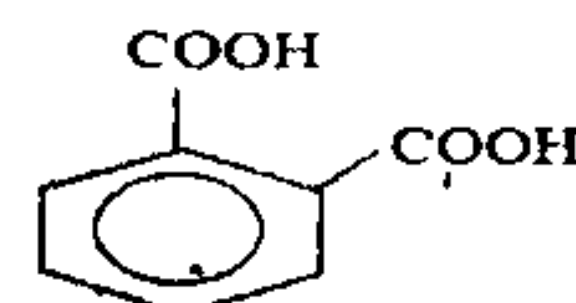
(b).. Formula of strearic acid is: $C_{17}H_{35}COOH$

5. **Write structural formulae of these compounds. (a) Phthalic acid (b) tartaric acid**

Ans: **Structural formulae:**

Phthalic acid (benzene ring with COOH, COOH)

Tartaric acid

$$\begin{array}{c} OH-CH-COOH \\ | \\ OH-CH-COOH \end{array}$$

6. **Write down structural formula of: (a) proponoic acid (b) Oxalic acid (c) Benzoic acid (d) Acetic anhydride.**

Ans: **Propanoic acid:**

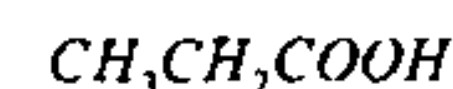
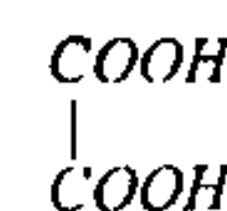
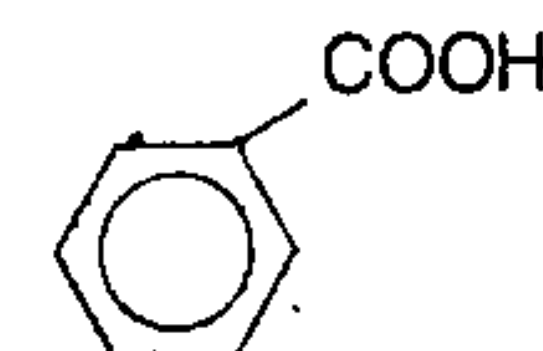
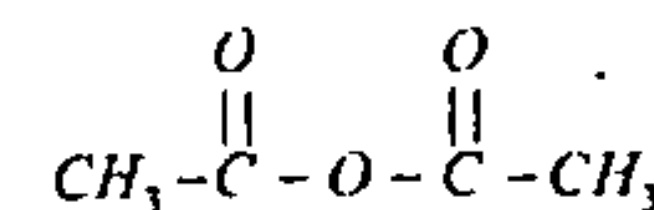
CH_3CH_2COOH

Oxalic acid:

$$\begin{array}{c} COOH \\ | \\ COOH \end{array}$$

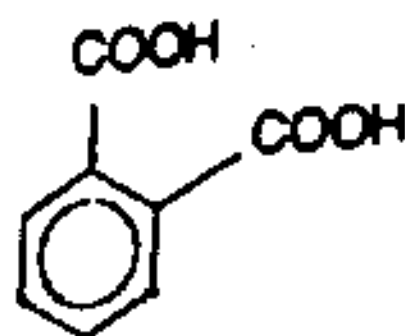
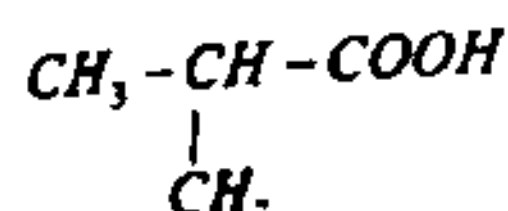
Benzoic acid: (benzene ring with COOH)

Acetic anhydride

$CH_3-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-CH_3$

7. Write down formulas of (i) Phthalic acid (ii) Iso-Butyric acid

Ans:

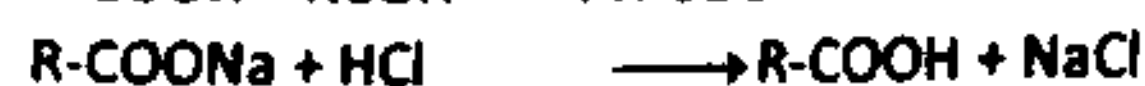
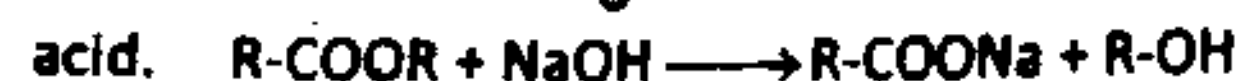
Phthalic acid: benzene ring with two adjacent COOH groups

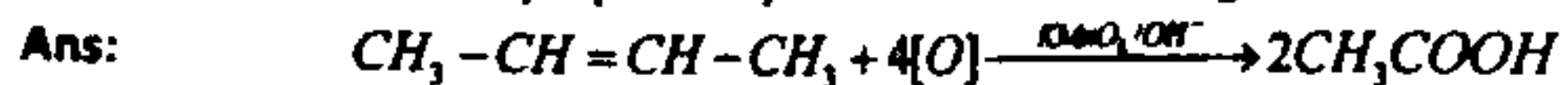
Iso-Butyric acid: $CH_3-CH(CH_3)-COOH$

Topic No: 13.3

8 How hydrolysis of ester leads the formation of acetic acid?

Ans: The ester on boiling with concentrated sodium hydroxide yields sodium salt of the acid. This resulting salt when treated with dilute HCl gives the free carboxylic acid.

$$R\text{-}COOR + NaOH \longrightarrow R\text{-}COONa + R\text{-}OH$$

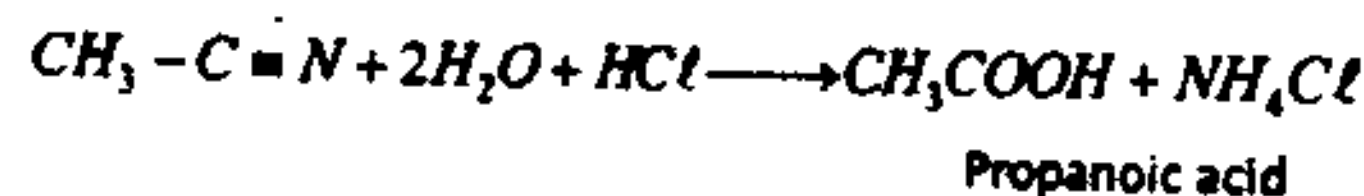
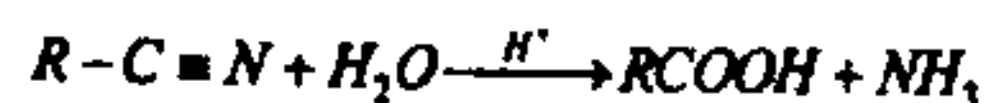
$$R\text{-}COONa + HCl \longrightarrow R\text{-}COOH + NaCl$$

9 How acetic acid is prepared by the oxidative cleavage of 2-butene? (2 times)

Ans: $$CH_3-CH=CH-CH_3 + 4[O] \xrightarrow{KMnO_4/OH^-} 2CH_3COOH$$

10. How are carboxylic acids prepared from alkyl nitrites.

Ans:

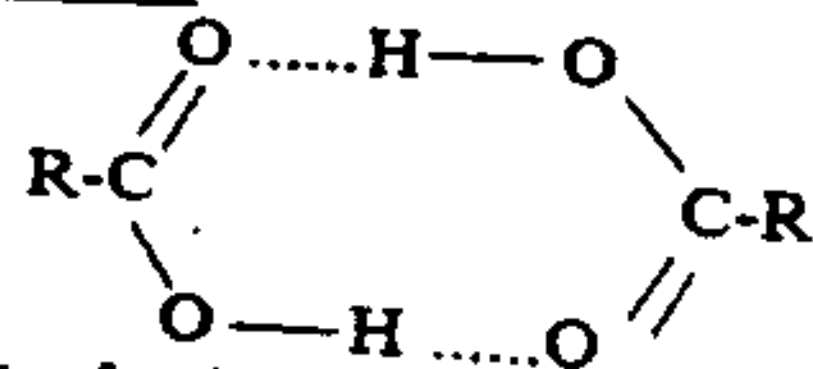
$$R-C\equiv N + H_2O \xrightarrow{H^+} RCOOH + NH_3$$

$$CH_3-C\equiv N + 2H_2O + HCl \longrightarrow CH_3COOH + NH_4Cl$$

Propanoic acid

Topic No: 13.4

11. Drawdimerofacarboxylic acid?

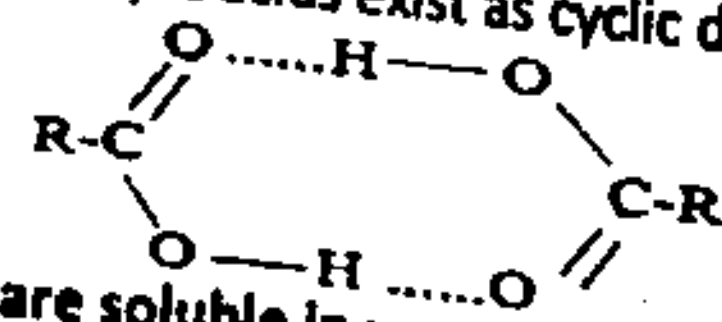
Ans: Dimer of a carboxylic acid:-

R-C(=O)-O—H ...... O=C(-R)-O—H ...... O (cyclic dimer)

12. Give trend of solubility of carboxylic acids in water.

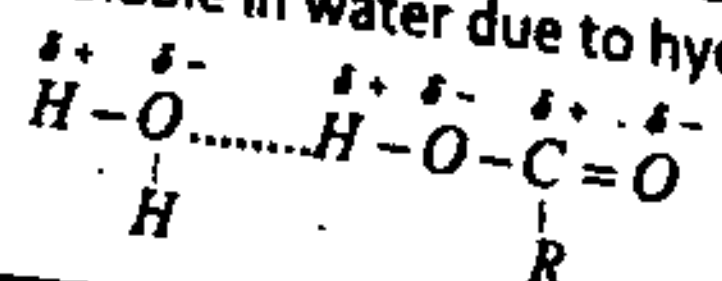
Ans: Among the aliphatic acids, the first four members are very soluble in water due to hydrogen bonding. The solubility in water gradually decreases with the increase in molecular mass due to weaken hydrogen bonding in higher carboxylic acids.

13. Why B.P(boiling point)of carboxylic acid are relatively high?

Ans: The boiling point of carboxylic acids are relatively high due to intermolecular hydrogen bonding. The molecular mass determination in non - polar solvents like benzene shows that carboxylic acids exist as cyclic dimers.

R-C(=O)-O—H ...... O=C(-R)-O—H ...... O (cyclic dimer)

14. Why Carboxylic Acids are soluble in water? Give example.

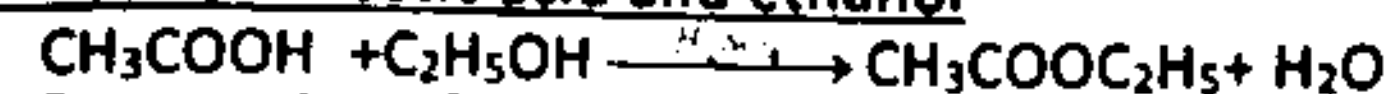
Ans: The carboxylic acids are soluble in water due to hydrogen bonding.

$$\overset{\delta+}{H}-\overset{\delta-}{\underset{|}{O}}\text{.......}\overset{\delta+}{H}-\overset{\delta-}{O}-\overset{\delta+}{C}=\overset{\delta-}{O}$$
(H on the water O; R on the C)

Topic No: 13.6/a

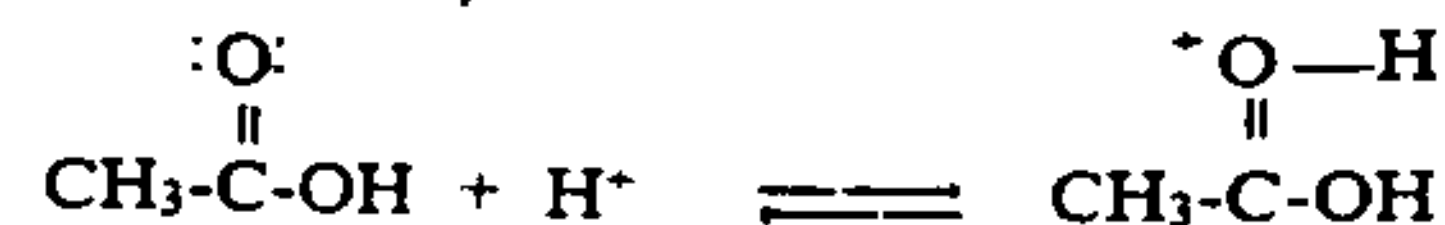
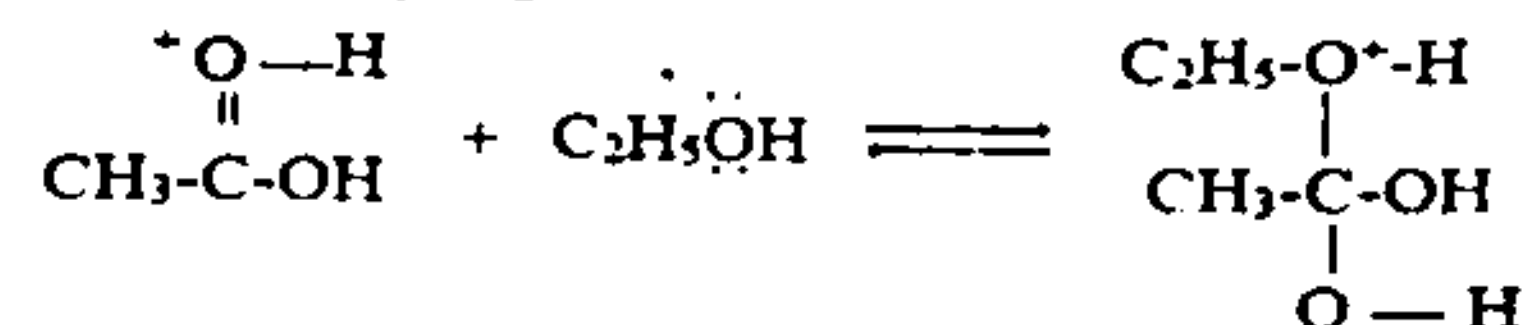
15 Write down mechanism of reactions (4 times)

(a) Between acetic acid and ethanol (b) Acetic acid and thinoyl chloride

Ans: (a).. Between acetic acid and ethanol

$$CH_3COOH + C_2H_5OH \xrightarrow{H^+} CH_3COOC_2H_5 + H_2O$$

(i).. Protonation of carboxylic acid

$$CH_3\text{-}C(=\ddot{O})\text{-}OH + H^+ \rightleftharpoons CH_3\text{-}C(={}^+O\text{-}H)\text{-}OH$$

(ii).. Attack of CH_3-CH_2- OH

$$CH_3\text{-}C(={}^+O\text{-}H)\text{-}OH + C_2H_5\ddot{O}H \rightleftharpoons CH_3\text{-}C(OH)(O\text{-}H)(C_2H_5\text{-}O^+\text{-}H)$$

(iii).. Hydrogen Ion Transfer

$$CH_3\text{-}C(OH)(O\text{-}H)(C_2H_5\text{-}O^+\text{-}H) \rightleftharpoons CH_3\text{-}C(O\text{-}H)(C_2H_5\text{-}O)(\overset{+}{O}H H)$$

(iv).. Elimination of Water and H⁺

$$CH_3\text{-}C(O\text{-}H)(C_2H_5\text{-}O)(\overset{+}{O}H H) \xrightarrow[-H^+]{-H_2O} CH_3\text{-}C(=O)\text{-}O\text{-}C_2H_5$$

(b).. Acetic acid and thinoyl chloride

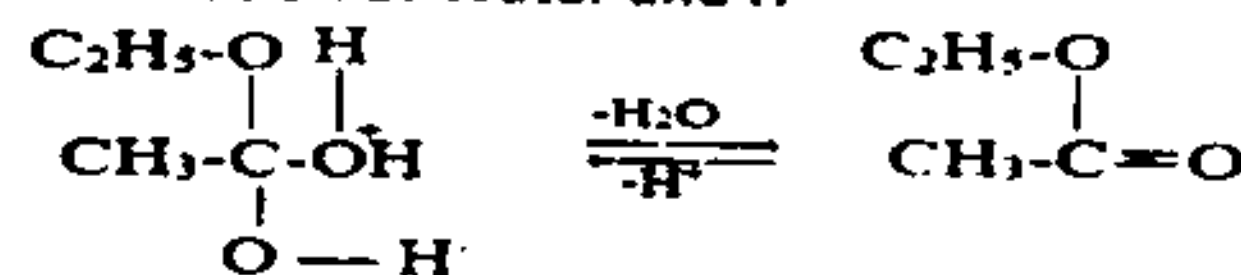
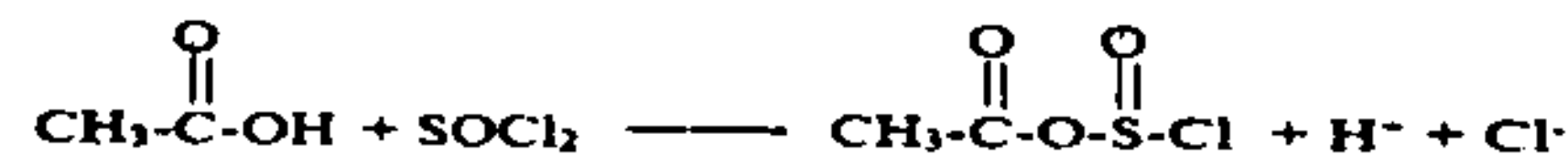
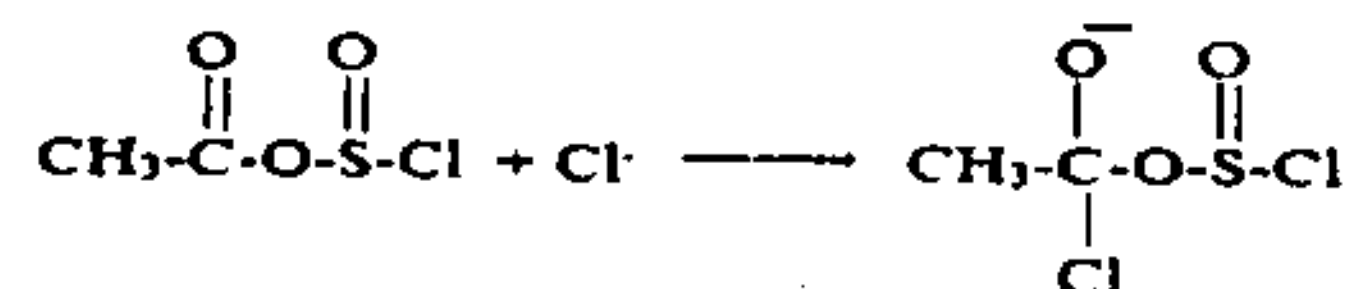
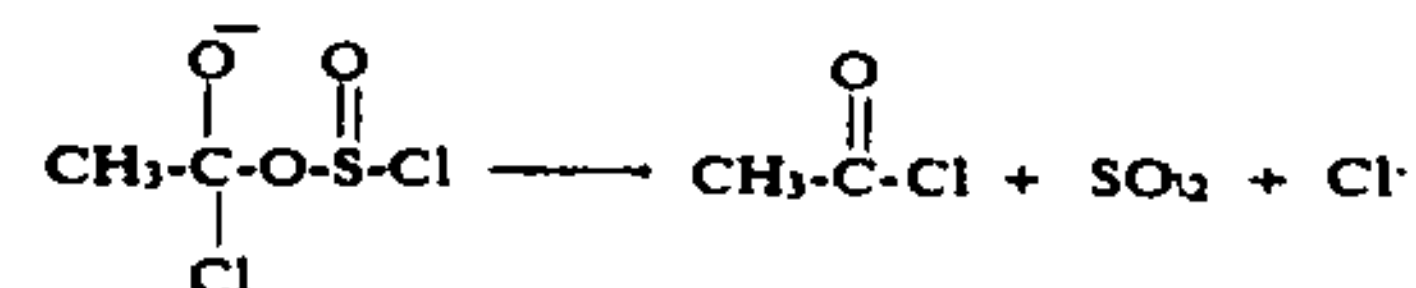
(i)..

$$CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}OH + SOCl_2 \longrightarrow CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}O\text{-}\overset{O}{\overset{\|}{S}}\text{-}Cl + H^+ + Cl^-$$

(ii)..

$$CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}O\text{-}\overset{O}{\overset{\|}{S}}\text{-}Cl + Cl^- \longrightarrow CH_3\text{-}\overset{\bar{O}}{\overset{|}{C}}(Cl)\text{-}O\text{-}\overset{O}{\overset{\|}{S}}\text{-}Cl$$

(iii)..

$$CH_3\text{-}\overset{\bar{O}}{\overset{|}{C}}(Cl)\text{-}O\text{-}\overset{O}{\overset{\|}{S}}\text{-}Cl \longrightarrow CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}Cl + SO_2 + Cl^-$$

Acetyl chloride

16 Prove by equations that CH_3COOH is used to prepare. (2 times)

(a)acetyl chloride (b)acetic anhydride

Ans: (a)acetyl chloride

(i)..

$$CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}OH + SOCl_2 \longrightarrow CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}O\text{-}\overset{O}{\overset{\|}{S}}\text{-}Cl + H^+ + Cl^-$$

(ii)..

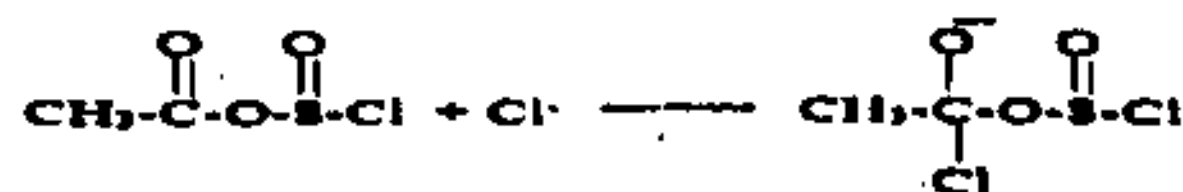
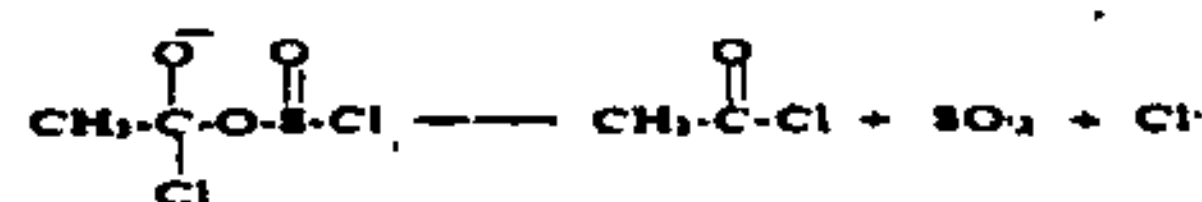
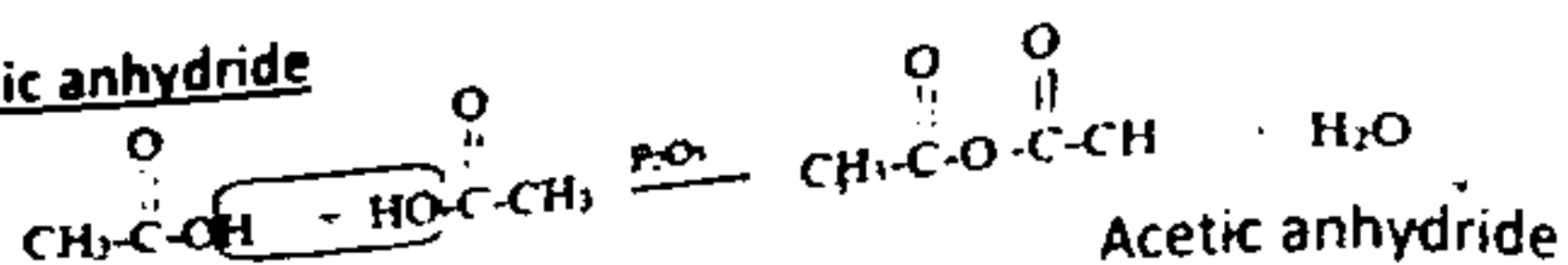
$$CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}O\text{-}\overset{O}{\overset{\|}{S}}\text{-}Cl + Cl^- \longrightarrow CH_3\text{-}\overset{\bar{O}}{\overset{|}{C}}(Cl)\text{-}O\text{-}\overset{O}{\overset{\|}{S}}\text{-}Cl$$

(iii)..

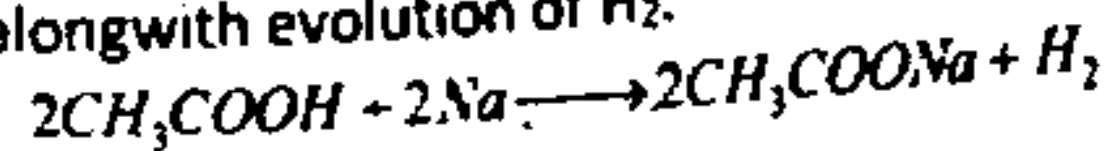
$$CH_3\text{-}\overset{\bar{O}}{\overset{|}{C}}(Cl)\text{-}O\text{-}\overset{O}{\overset{\|}{S}}\text{-}Cl \longrightarrow CH_3\text{-}\overset{O}{\overset{\|}{C}}\text{-}Cl + SO_2 + Cl^-$$

Acetyl chloride

(b)acetic anhydride

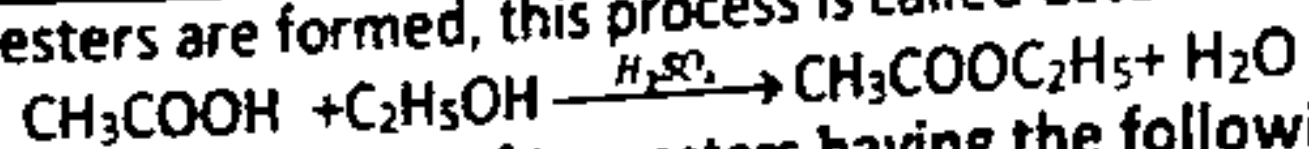
$$CH_3-\overset{O}{\overset{||}{C}}-OH + HO-\overset{O}{\overset{||}{C}}-CH_3 \xrightarrow{P_2O_5} CH_3-\overset{O}{\overset{||}{C}}-O-\overset{O}{\overset{||}{C}}-CH_3 + H_2O$$

Acetic anhydride

17. **What happens when carboxylic acids react with metals?** What happens when carboxylic acids react with active metals like Na, K, Ca, Mg etc to form their salts

Ans: Carboxylic acids react with active metals like Na, K, Ca, Mg etc to form their salts alongwith evolution of H_2.

$$2CH_3COOH + 2Na \longrightarrow 2CH_3COONa + H_2$$

Topic No: 13.6/b

18 **Manipulate the term 'Esterification' using ethyl alcohol as an example?**

Ans: **Esterification:-** When carboxylic acids are heated in the presence of concentrated H_2SO_4 esters are formed, this process is called esterification process.

$$CH_3COOH + C_2H_5OH \xrightarrow{H_2SO_4} CH_3COOC_2H_5 + H_2O$$

19. **Write down the names of two esters having the following flavours:**

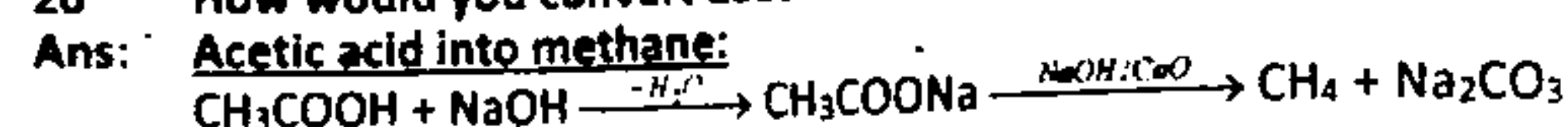
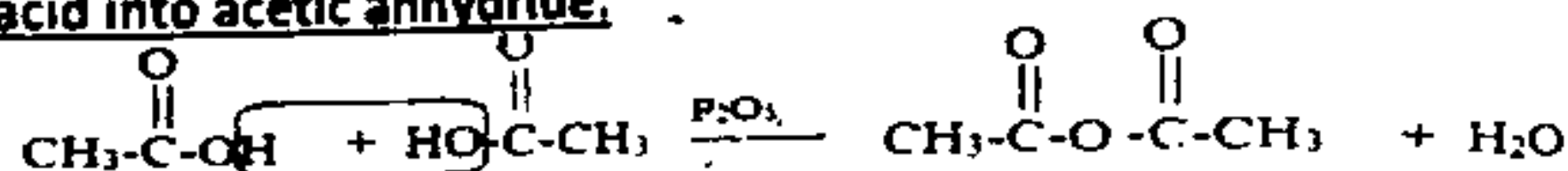
(i) Pineapple **(ii)Jasmine**

Ans: (i).. Pineapple flavour is produced by Ethyl butyrate.

(ii).. Jasmineflavour is produced by Benzylacetate.

20 **How would you convert acetic acid into methane and acetic anhydride?** (2 times)

Ans: **Acetic acid into methane:**

$$CH_3COOH + NaOH \xrightarrow{-H_2O} CH_3COONa \xrightarrow{NaOH/CaO} CH_4 + Na_2CO_3$$

Acetic acid into acetic anhydride:

$$CH_3-\overset{O}{\overset{||}{C}}-OH + HO-\overset{O}{\overset{||}{C}}-CH_3 \xrightarrow{P_2O_5} CH_3-\overset{O}{\overset{||}{C}}-O-\overset{O}{\overset{||}{C}}-CH_3 + H_2O$$

21. **Write the mechanism of Amide formation.**

Ans: **Mechanism of Amide formation:**

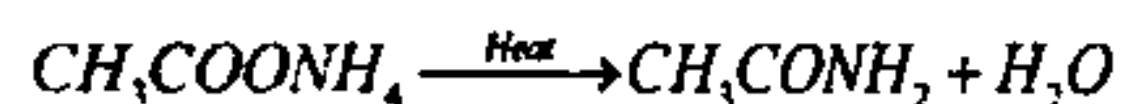
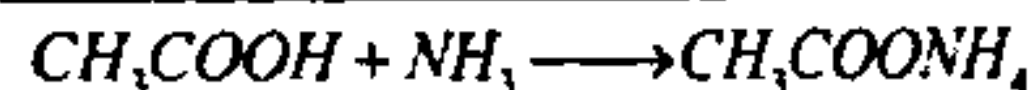
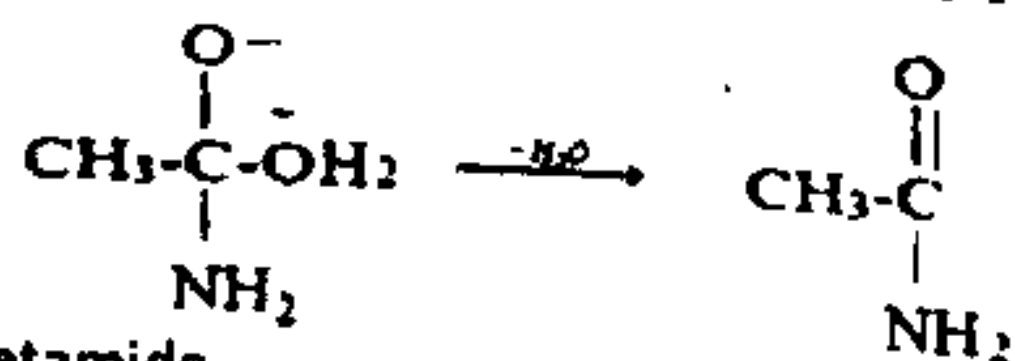
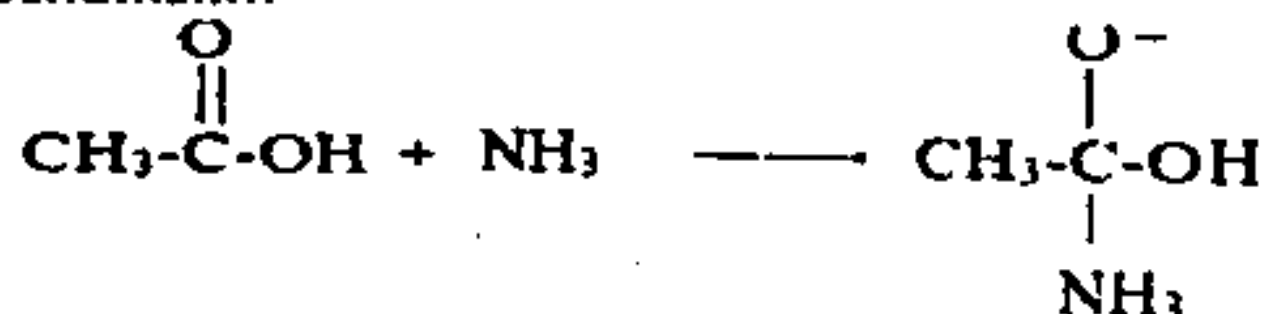
$$CH_3COOH + NH_3 \longrightarrow CH_3COONH_4$$

$$CH_3COONH_4 \xrightarrow{Heat} CH_3CONH_2 + H_2O$$

Mechanisim:

$$CH_3-\overset{O}{\overset{||}{C}}-OH + NH_3 \longrightarrow CH_3-\overset{O^-}{\overset{|}{\underset{NH_3}{\underset{|}{C}}}}-OH$$

$$CH_3-\overset{O^-}{\overset{|}{\underset{NH_3}{\underset{|}{C}}}}-OH \xrightarrow{\text{Rearrange}} CH_3-\overset{O^-}{\overset{|}{\underset{NH_2}{\underset{|}{C}}}}-OH_2$$

$$CH_3-\overset{O^-}{\overset{|}{\underset{NH_2}{\underset{|}{C}}}}-OH_2 \xrightarrow{-H_2O} CH_3-\overset{O}{\overset{||}{\underset{NH_2}{\underset{|}{C}}}}$$

Acetamide

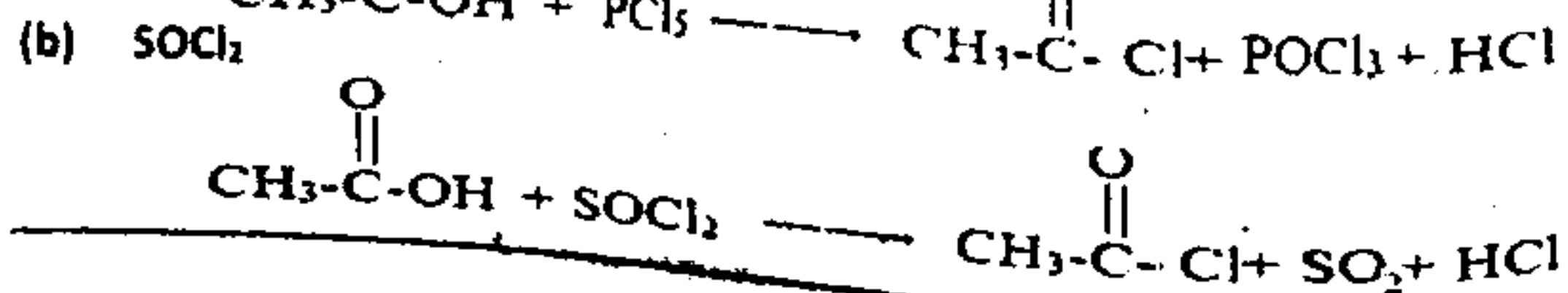
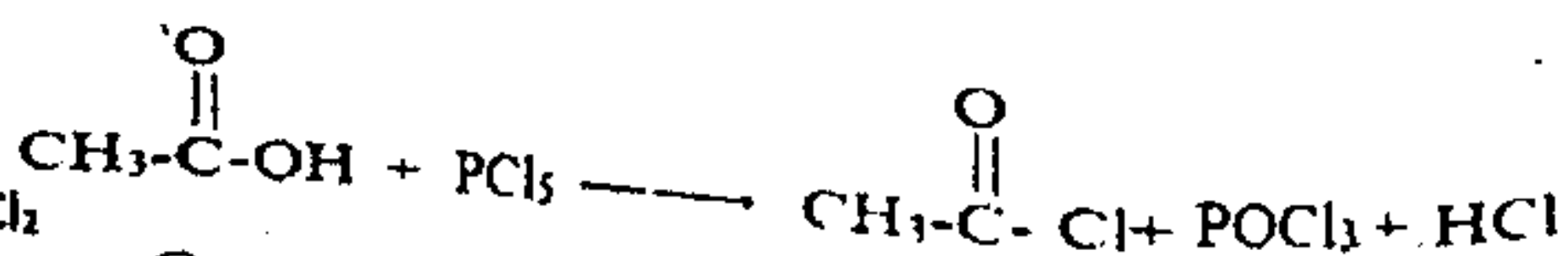
22 **How acetic acid reacts with (a) PCl_5 (b) $SOCl_2$** (2 times)

Ans:

(a) PCl_5

$$CH_3-\overset{O}{\overset{||}{C}}-OH + PCl_5 \longrightarrow CH_3-\overset{O}{\overset{||}{C}}-Cl + POCl_3 + HCl$$

(b) $SOCl_2$

$$CH_3-\overset{O}{\overset{||}{C}}-OH + SOCl_2 \longrightarrow CH_3-\overset{O}{\overset{||}{C}}-Cl + SO_2 + HCl$$

23. **Which Ester gives banana and orange smell?**

Ans: Amylacetate gives banana while octylacetate gives orange smell.

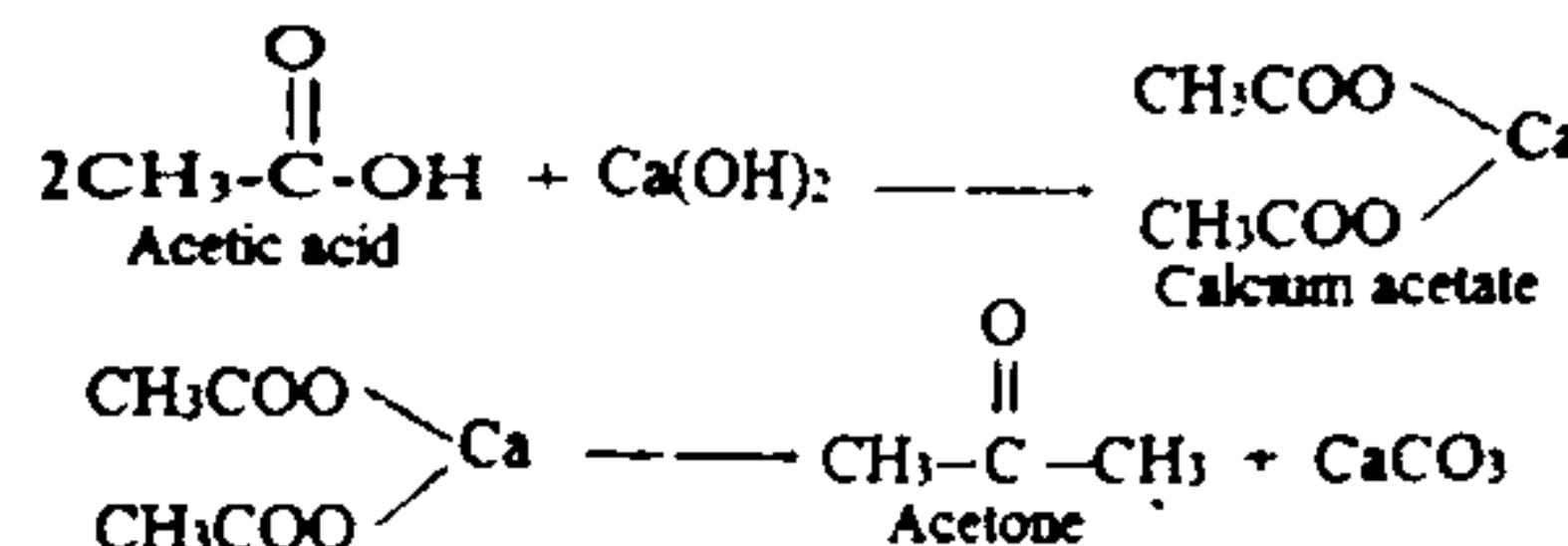
24 **Convert acetic acid into Ketone.**

Ans:

$$2CH_3-\overset{O}{\overset{||}{C}}-OH + Ca(OH)_2 \longrightarrow (CH_3COO)_2Ca$$

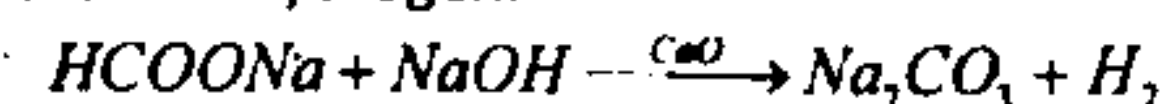
Acetic acid → Calcium acetate

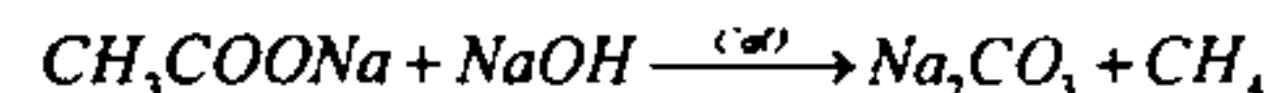
$$(CH_3COO)_2Ca \longrightarrow CH_3-\overset{O}{\overset{||}{C}}-CH_3 + CaCO_3$$

Acetone

25 **What happens when followings are heated?** (2 times)

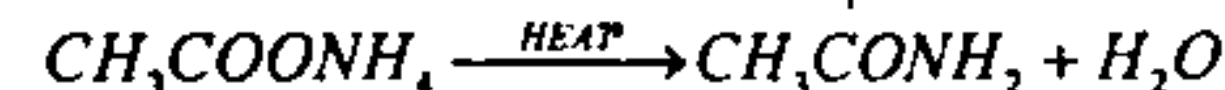
(a) Sodium Format and soda lime (b) Sodium Acetate and Soda Lime

Ans: **(a):** When sodium formateis heated with soda lime, it decomposes to give sodium carbonate and hydrogen.

$$HCOONa + NaOH \xrightarrow{CaO} Na_2CO_3 + H_2$$

(b) When sodium acetate is heated with soda lime, it decomposes to give sodium carbonate and methane.

$$CH_3COONa + NaOH \xrightarrow{CaO} Na_2CO_3 + CH_4$$

26 **What happens when ammonium acetate is heated?**

Ans: When ammonium acetate is heated it produce acid amide:

$$CH_3COONH_4 \xrightarrow{HEAT} CH_3CONH_2 + H_2O$$

Topic No: 13.6/c

27 **Prepare ethane from acetic acid by reduction with HI\P?**

Ans: Acetic acid on reduction with HI and red phosphorus give ethane.

$$CH_3COOH + 6HI \xrightarrow{P} CH_3-CH_3 + 2H_2O + 3I_2$$

28. **Prepare alcohol and alkane from carboxylic acid.** (2 times)

Ans: **Preparation of alcohol and alkane from carboxylic acid:**

Carboxylic acids on reduction with lithium aluminium hydride ($LiAlH_4$) are reduced to alcohols.

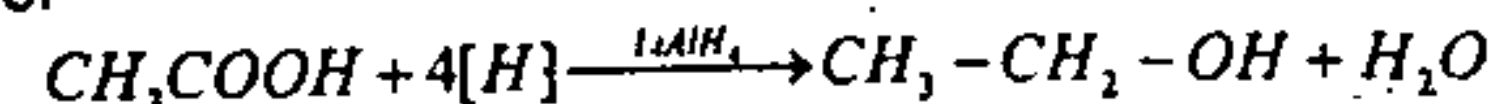
$$CH_3COOH + 4[H] \xrightarrow{LiAlH_4} CH_3CH_2OH + H_2O$$

Carboxylic acids on reduction with HI and red phosphorous give alkanes.

$$CH_3COOH + 6HI \xrightarrow{P} CH_3-CH_3 + 2H_2O + 3I_2$$

29 **How acetic acid can be converted into ethyl alcohol.**

Ans: Carboxylic acid on reaction with lithium aluminium hydride ($LiAlH_4$) are reduced to alcohol

$$CH_3COOH + 4[H] \xrightarrow{LiAlH_4} CH_3-CH_2-OH + H_2O$$

30 **Write down the I.U.P.A.C. names of: (a)$CH_2(COOH)_2$**

Ans: (a)$CH_2(COOH)_2$: Propanedioic acid

Topic No: 13.7

31 **Give four uses of acetic acid?** (2 times)

Ans: Acetic acid is used:

(i). as a coagulant for latex in rubber industry.

(ii). in the manufacture of plastics (polyvinyl acetate) rayon (cellulose acetate) and silk.

(iii). in medicine as a local irritant.

(iv). as a solvent in the laboratory for carrying out reactions.

(v). in the manufacturing of pickles.

(vi). in the manufacturing of many organic compounds like acetone, acetates and esters.

SHORT QUESTIONS OF CHAPTER-15 COMMON CHEMICAL INDUSTRIES IN PAKISTAN ACCORDING TO ALP SMART SYLLABUS-2020-21

Topic No: 15.3

1 Distinguish micronutrients and macronutrients for plants? (17 times)

Ans: **Micronutrients:** The nutrients which are required in a very small amount for the growth of plant, are called micro-nutrients. These include, Boron, Copper, Iron, Manganese, Zinc, Molybdenum and Chlorine. These are generally required in quantities ranging from 6 g to 200 g per acre.

Macronutrients: The nutrients which are required in a large amount for the growth of plants, are called macro-nutrients. These include Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Sulphur, Carbon, Hydrogen and Oxygen. These are generally required in quantities ranging from 5 Kg to 200 kg per acre.

Topic No: 15.4

2 Enlist steps involved in the manufacture of urea?

Ans: Urea is produced by the reaction of liquid ammonia with gaseous carbon dioxide. Following steps are involve in the manufacture of urea.

(i).. Preparation of hydrogen and carbon dioxide
(ii).. Preparation of ammonia
(iii).. Preparation of Ammonium Carbamate
(iv).. Preparation of urea
(v).. Concentration of Urea
(vi).. Prilling

3 Write a note on diammonium phosphate?

Ans: This compound of fairly high purity is prepared by continuous process that consists of reacting anhydrous ammonia gas and pure phosphoric acid at 60-70 °C and pH 5.8-6.0.

$$2NH_3(g) + H_3PO_4 \longrightarrow (NH_4)_2HPO_4 + \text{heat}$$

It is an exothermic reaction. The heat of reaction vaporized water from the liquor and the crystals of diammonium phosphate are taken out, centrifuged, washed and dried. It contains 16% nitrogen and 48% P_2O_5. This product contains about 75% plant nutrients and is deemed suitable for used either alone or mixed with other fertilizers.

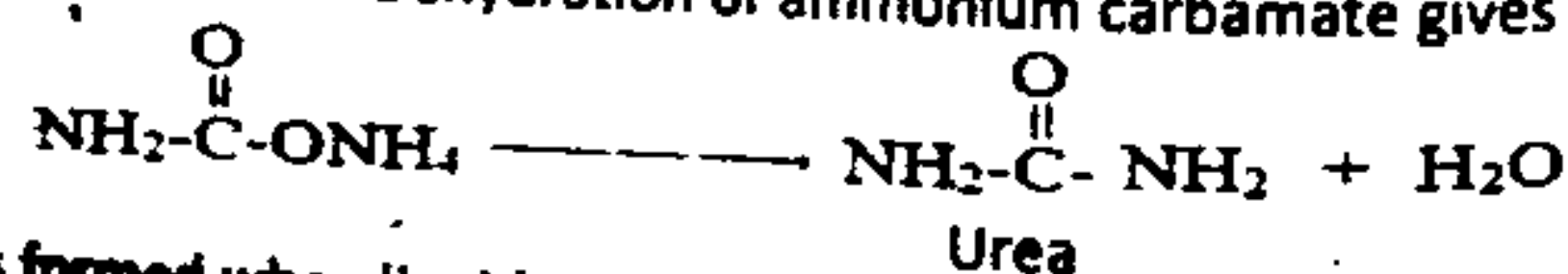
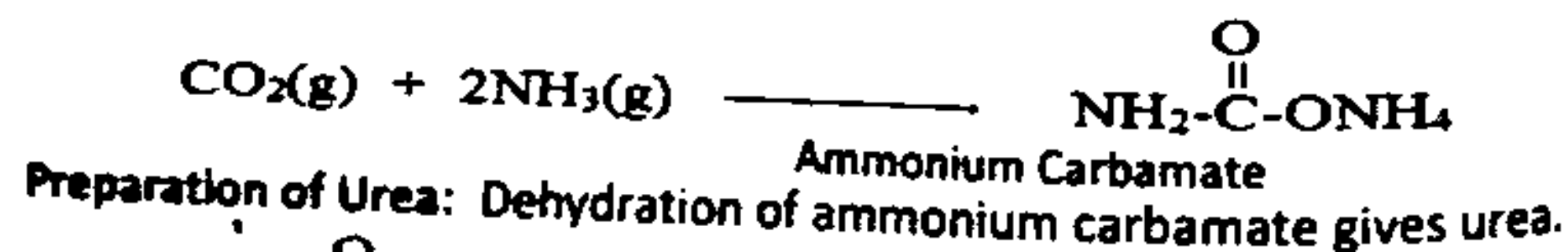
4 Give reactions of preparation of urea by using NH_3 and CO_2 (2 times)

Ans: **Preparation of Ammonium Carbamate:** Gaseous carbon dioxide is mixed with ammonia in the volume ratio of 1:2 in a reactor to produce ammonium carbamate.

$$CO_2(g) + 2NH_3(g) \longrightarrow NH_2\text{-}\overset{\overset{O}{\|}}{C}\text{-}ONH_4$$

Ammonium Carbamate

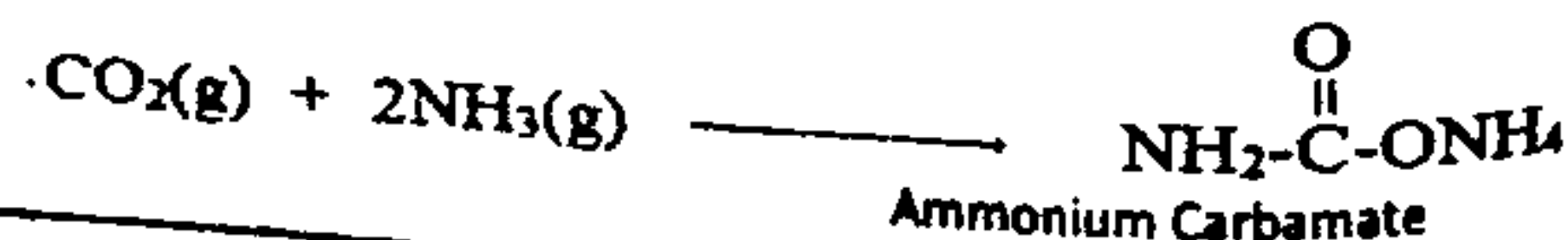
Preparation of Urea: Dehydration of ammonium carbamate gives urea.

$$NH_2\text{-}\overset{\overset{O}{\|}}{C}\text{-}ONH_4 \longrightarrow NH_2\text{-}\overset{\overset{O}{\|}}{C}\text{-}NH_2 + H_2O$$

Urea

5 What is formed when liquid NH_3 and CO_2 react with each other?

Ans: **Reaction of liquid NH_3 and CO_2:-**

$$CO_2(g) + 2NH_3(g) \longrightarrow NH_2\text{-}\overset{\overset{O}{\|}}{C}\text{-}ONH_4$$

Ammonium Carbamate

6 Brief about prilling of urea? (3 times)

Ans: The molten urea is sprayed at the prilling tower by means of prilling bucket where it is cooled by the air rising upward. Molten droplets solidify into the form of prills. Urea prills thus produced are either sent to the bagging section or to the bulk storage

7 Write down formulas for Superphosphate and triple phosphate? (2 times)

Ans: Superphosphate: $Ca(H_2PO_4)_2$
Triple phosphate: $(NH_4)_2HPO_4$

8 Ammonium nitrate cannot be used as a fertilizer for paddy rice?Summarize with reason?

Ans: Ammonium nitrate cannot be used as a fertilizer for paddy rice because the microbial bacteria in flooded fields decomposes it to nitrogen gas.

9 Ammonium nitrate is a useful fertilizer for many crops except paddy rice. Why?

Ans: Ammonium nitrate cannot be used as a fertilizer for paddy rice because the microbial bacteria in flooded fields decomposes it to nitrogen gas.

10 Give percentage of nitrogen in Urea ,Ammonium nitrate, Diammonium hydrogen phosphate and KNO_3?

Ans: **Percentage of nitrogen:-**

Percentage of nitrogen in Urea = 46%
Percentage of nitrogen in Ammonium nitrate =33-33.5%
Percentage of nitrogen in Diammonium hydrogen phosphate = 16%
Percentage of nitrogen in KNO_3= 13%

11 Explain the importance of potassium fertilizer? (2 times)

Ans: **Importance of potassium fertilizer:-**

Potassium fertilizers provide potassium to the plant or soil. Potassium is required for the formation of starch, sugar and the fibrous material of the plant. They increase resistance to diseases and make the plants strong by helping in healthy root development. They also help in ripening of seeds, fruits and cereals. Potassium fertilizers are especially useful for tobacco, coffee, potato and corn.

12 How urea is manufactured?Write its reactions. (2 times)

Ans: **Manufactured or Urea:-**

Urea is produced by the reaction of liquid ammonia with gaseous carbon dioxide. Following steps are involved in the manufacture of urea.

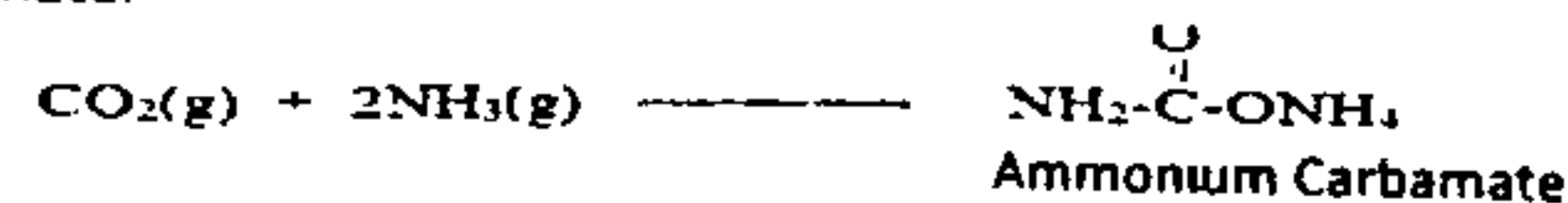
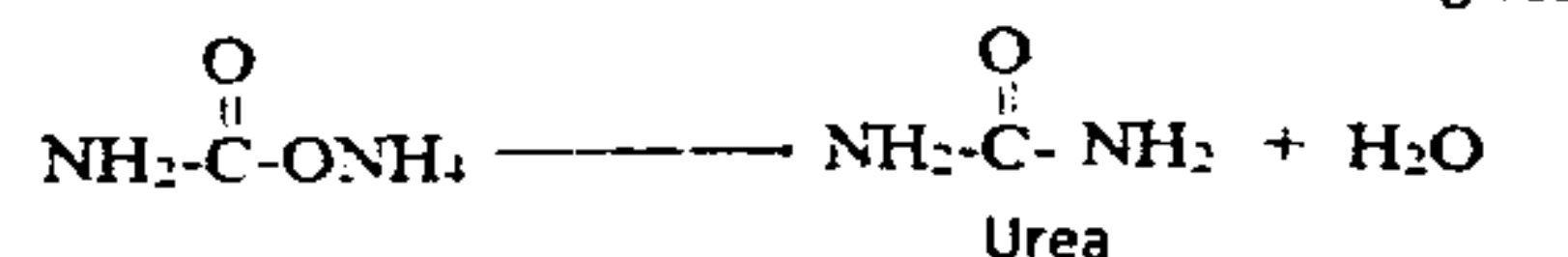
(i).. Preparation of hydrogen and carbon dioxide.
(ii).. Preparation of ammonia
(iii).. Preparation of Ammonium Carbamate
(iv).. Preparation of urea
(v).. Concentration of Urea
(vi).. Prilling

Preparation of Ammonium Carbamate: Gaseous carbon dioxide is mixed with ammonia in the volume ratio of 1:2 in a reactor to produce ammonium carbamate.

$$CO_2(g) + 2NH_3(g) \longrightarrow NH_2\text{-}\overset{\overset{O}{\|}}{C}\text{-}ONH_4$$

Ammonium Carbamate

Preparation of Urea: Dehydration of ammonium carbamate gives urea.

$$NH_2\text{-}\overset{\overset{O}{\|}}{C}\text{-}ONH_4 \longrightarrow NH_2\text{-}\overset{\overset{O}{\|}}{C}\text{-}NH_2 + H_2O$$

Urea

Concentration of Urea Solution:-

The urea solution is concentrated in an evaporation section where water is evaporated by heating with steam under vacuum in two evaporation stages whereby 99.7% urea melt is obtained. It is then pumped to prilling tower.

Prilling:-
The molten urea is sprayed at the prilling tower by means of prilling ... where it is cooled by the air rising upward. Molten droplets solidify into the ... of prills. Urea prills thus produced are either sent to the bagging section or ... bulk storage.

13 Why nitrogen is important for plants?

Ans: **Importance of nitrogen for plants:-**
Nitrogen is required during the early stage of plant growth for the develop... of stems and leaves. It is the main constituents of protein, imparts green ... to the leaves and enhance the yield and quality of the plants.

14. What is the function of phosphatic fertilizers in plants?

Ans: **Function of phosphatic fertilizers in plants:**
Phosphorus is required to stimulate early growth, to accelerate the seed and ... formation during the later stages of growth. It also increases resistance ... diseases. The various phosphatic fertilizers have different composition ... which they have different solubilities.

15. What are phosphatic fertilizers? Give two formulas of phosphatic fertilizers (13 times)

Ans: **Phosphatic fertilizers:**
The fertilizers provide phosphorus to the plants or soil. Various phosp... fertilizers have different compositions. The most important water soluble ferti... are super phosphate (calcium super phosphate) $Ca(H_2PO_4)_2$ and triple phosp... (diammonium – phosphate $(NH_4)_2HPO_4$

16 What is the role of K(potassium) in growth of plant?

Ans: Potassium is required for the formation of starch, sugar and the fibrous ma... of the plant. They increase resistance to disease and make the plants strong ... helping in healthy root development. They also help in ripening of seeds, ... and cereals. Potassium fertilizers are especially useful for tobacco, coffee, ... and corn.

17. What are Phosphatic fertilizers.

Ans: Those fertilizers which provide phosphorous to plants.
e.g; Super phosphate $(Ca(H_2PO_4)_2)$, Diammonium phosphate $((NH_4)_2HPO_4)$ ...

Topic No: 15.5

18 What is the difference between clinker and cement? (2 times)

Ans: **Clinker:** The resulting product obtained from the kiln is known as cement clinker. This has the appearance of greenish black or grey coloured balls var... in size from small nuts to peas.
Cement: Cement is the material obtained by burning an intimate mix... of calcareous and argillaceous materials at sufficiently high temperature ... produce clinkers. These clinkers are then ground to a fine powder.

19 Give different zones in the rotary kiln and their temperature. (2 times)

Ans: (a).. Drying or pre-heating zone (minimum temperature zone at 500 °C)
(b).. Decomposition zone (Moderate temperature zone upto 900°C)
(c).. Burning zone (Maximum temperature zone upto 1500 °C)
(d).. Cooling zone (upto 150 -152 °C)

20 Give an idea about clinker? (3 times)

Ans: The resulting product obtained from the kiln is known as cement clinker. This ... the appearance of greenish black or grey coloured balls varying in size from small nuts to peas.

21 What are the prospect of the cement industry in Pakistan?

Ans: At the time of partition in 1947, there were four cement plants in West Pak... which produced about 330,000 tons of cement every year. However in 1954 ... production of cement went up to 660,000 tons, in 1956 two more cement factories were set up at DaudKhel and Hyderabad, but even then the product... of cement was not enough to meet the increasing demand of the construction industry in the country.

For a developing country like Pakistan there is always an increasing need of cement for development projects. Efforts were thus made to build more factories. At present there are about 22 cement factories in private as well as in public sectors, which are manufacturing cement both by dry and wet process. The total production of these 22 cement plants is 9,578,802 tons/annum

22 Define cement. Give its essential components? (8 times)

Ans: **Cement and its essential components:-**
Cement is the material obtained by burning an intimate mixture of calcarious and argillaceous materials at sufficiently high temperature to produce clinkers. These clinkers are then ground to a fine powder

Essential components of cement:-
(i).. Calcarious material (limestone, marble, chalks, marine shell) as source of CaO.
(ii).. Argillaceous material (clay, shale, slate, blast furnace slag) they provide acidic components such as aluminates and silicates.
(iii).. Gypsum.

23 Draw flow sheet diagram for the manufacture of cement? (3 times)

Ans: **Flow sheet diagram for the manufacture of cement:-**

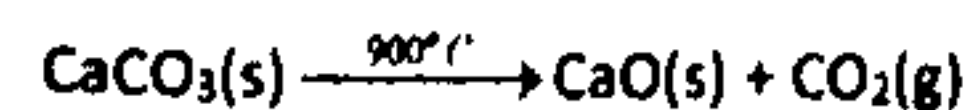
Lime stone ⟶ Rotary crusher ⟶ Rotary screen ⟶ Fine Grain
↓
Cooler ⟵ Clinker Hopper ⟵ Collecting Tank ⟵ Wash Mills
↓
Clinker Grinder ⟶ Grinder ⟶ Cement Silos ⟶ Bagging
↓
Cement Transport

24 Describe chemical changes that occur in the different zones during the manufacture of cement? (4 times)

Ans: **Chemical changes that occur in the decomposition and zone's:-**

(a).. Drying or pre-heating Zone (minimum temperature zone)
In this zone the temperature is kept at 500°C, whereby the moisture is removed and the clay is broken into Al_2O_3, SiO_3 and Fe_2O_3.

(b).. Decomposition Zone (Moderate temperature zone)
Here the temperature goes upto 900 °C. In this zone the limestone ($CaCO_3$) decomposes into lime (CaO) and CO_2.

$$CaCO_3(s) \xrightarrow{900°C} CaO(s) + CO_2(g)$$

(c).. Burning Zone (Maximum temperature zone)
In this zone, the temperature goes up to 1500 °C and the oxides e.g. CaO, SiO_2, Al_2O_3 and Fe_2O_3 combine together and form calcium silicate, calcium aluminate and calcium ferrite.

(d).. Cooling Zone
This is the last stage in the kiln where the charge is cooled up to 150-200°C.

25 What do you mean by Calcarious materials and Argillaceous material used in the manufacturing of cement? (4 times)

Ans: **Calcarious and Argillaceous material:-**

Calcarious material:-

Calcarious material (limestone, marble, chalks, marine shell) as source of CaO.

Argillaceous material:-

Argillaceous material (clay, shale, slate, blast furnace slag) they provide acidic components such as aluminates and silicates.

26 Just write five stages involved in the manufacturing of Portland Cement? (2 times)

Ans: **Stages involved in the manufacturing of Portland Cement:-**

(i). Crushing and Grinding of raw materials.
(ii). Mixing of the Raw Material into correct proportion.
(iii). Heating the slury in a Rotary Kiln.
(iv). Grinding the heated product known as clinker.
(v). Mixing and grinding of the cement clinker with gypsum

27 What are clinkers? How are they converted into cement? (5 times)

Ans: **Clinkers and its conversion into cement:-**

The resulting product obtained from the kiln is known as cement clinker. This has the appearance of greenish black or grey coloured balls varying in size from small nuts to peas.

Clinkers conversion into cement:-

The cement clinkers are air cooled and ground with required amount of gypsum into fine powder.

28. Write various types of raw material used in preparation of cement. (3 times)

Ans: **Raw material used in the preparation of cement:**

The imoortant raw materials used ofr the manufacture of cement are:

(i). Calcarous material (limestone, marble, chalk, marine shell) as source of CaO.
(ii). Argilaceous material (Clay, shale, slate, blast furnace slag). They provide acidic components such as aluminates and silicates.
(iii). Other raw material being used in gypsem.

29. Define the term cement.

Ans: **Cement:** It is material obtained by burning an intimate mixture of calcarious and argillaceous materials at sufficiently high temperature to produce clinkers. These clinkers are then ground to a fine powder. The essential constituents are lime (obtained from limestone) silica and alumina (present in clay).

30 What reaction takes place in the setting of cement from 01 to 07 days? (3 times)

Ans: Tricalcium silicate ($3CaO.SiO_2$) and tri-calcium aluminate ($3CaO.Al_2O_3$) get hydrolyzed to produce calcium hydroxide and aluminium hydroxide. The calcium hydroxide, thus formed, starts changing into needle-shaped crystals, which get studded in the colloidal gel and impart strength to it. Amuminium hydroxide, on the other hand, fills the interstices resulting in hardening the mass. The gel formed starts losing water partly by evaporation and sets to a hard mass.